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NOTES ON ERIOGONUM - V
A REVISION OF THE ERIOGONUM CORYMBOSUM COMPLEXJames L. Reveal¹

The *E. corymbosum* complex, as here defined, includes those species of the genus which are woody perennial shrubs or subshrubs with large lanceolate to elliptic or orbicular leaves which are on the lower half of the stems. The *E. microthecum* complex (to be treated in a later paper) differs mainly in having leaves that are narrower and shorter on generally smaller plants.

Eriogonum corymbosum and its related species occur mainly in the Colorado and Green River drainage basins with one outlying species. The region is one of scant rainfall, warm temperatures, and high evaporation. Yet, the scanty vegetation of this region possesses numerous endemic species, and in the genus *Eriogonum*, the endemics are numerous and frequently encountered. The entities occur in a variety of habitats, ranging from hard gumbo clay hills to sandy desert flats and steep mountain slopes. However, rarely are the species of *Eriogonum* the dominant plant in any given site.

HISTORICAL REVIEW

The first species to be described in the complex was *Eriogonum corymbosum*. Bentham (1856) named this species from information supplied to him from John Torrey of New York, who had examined the 1845 Frémont collection. In order to show the close relationship between *E. microthecum* and *E. corymbosum*, Bentham proposed a new section, *Corymbosa*. At the same time, Bentham described *E. microthecum* var. *fendlerianum* from information sent to him by Asa Gray of Harvard University. This taxon was later elevated to the species rank by Small (1906). As Torrey & Gray were aware that Bentham was planning to publish *E. corymbosum* in de Candolle's *Prodromus*, they proposed *E. corymbosum* var. *divaricatum*, believing that their variety would appear before Bentham's revision was published. Fortunately, however, the Beckwith Report was delayed until 1857 and the new variety was published nearly a year

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after Bentham's paper. If the variety had appeared before 1856, the name would have been illegitimate.

Following these initial discoveries and papers, the few specimens that were collected were simply called *E. corymbosum*. In 1895, Marcus E. Jones distinguished the yellow-flowered plants as *E. aureum*. However, in 1902, Aven Nelson raised a question as to the use of the name *E. aureum*, noting that in Bentham's 1856 revision, this name had been cited in synonymy under *E. brevicaula* Nutt. In order to correct this seeming error, Nelson proposed the substitute name, *E. fruticosum*, for *E. aureum*. However, as Bentham was citing the epithet, *E. aureum*, in synonymy, the name had never been published and was still available to Jones. The Nelson substitute name is superfluous.

In a second article, Nelson (1904) described *E. salinum* from a small series of specimens from southern Wyoming. As it will be noted below, this particular collection (Nelson 3753) is the closest example found in this study to the Frémont collection which is the type of *E. corymbosum*.

When Jones described *E. aureum*, he also proposed two new varieties, var. *ambiguum* and var. *glutinosum*. The first is a form of *E. microthecum* from the east side of the Sierra Nevada mountains of California. By 1903, Jones recognized that his species, *E. aureum*, was nothing more than a variety of *E. corymbosum* and made the combination *E. corymbosum* var. *glutinosum* for the yellow-flowered form of the species from southern Utah and adjacent northern Arizona.

The elevation of *E. corymbosum* var. *divaricatum* to the species rank by Small (1906) as *E. divergens* saw a corresponding shift of the concept of this taxon away from its type to those specimens which are here called *E. corymbosum* var. *orbiculatum*. At the same time, Rydberg (1912) was modifying the concept of *E. jonesii* S. Wats. of northern Arizona to include specimens of var. *orbiculatum*. Rydberg's concept was subsequently incorporated in his *Flora of the Rocky Mountains and Great Plains* (1917). In Tidestrom's (1925) treatment of the genus, his key is written so that var. *orbiculatum* will key out to *E. nummulara* M. E. Jones. This misapplication has caused the herbarium folders of *E. nummulara* to bulge with a totally unrelated species. It was not until 1936 when Susan G. Stokes, in her monograph of the genus, noted these errors; yet, for the most part, they have persisted.

It has been difficult to comprehend the species alignments of the members of this complex as seen by Stokes. She placed most of the species related to *E. corymbosum* under the more or less unrelated High Plains species, *E. effusum* Nutt. At the same time she referred *E. aureum* to *E. microthecum*. From herbarium studies, several collections have been noted in which Stokes has given two or three different names to duplicates of the same collection. It seems likely that she never truly understood the species involved in either the *E. corymbosum* or *E. microthecum* complexes.

During the course of field work and herbarium studies conducted independently and together with Jack D. Brotherson and others, a number of new taxa related to *Eriogonum corymbosum* were found. The history of these discoveries will be discussed under each entity.

ACKNOWLEDGMENTS

I would like to express my appreciation to Dr. Stanley L. Welsh of Brigham Young University who made several suggestions on the various aspects of this paper and the species treated therein. I am indebted to Jack D. Brotherson, formerly a fellow graduate student at Brigham Young University, whose master's thesis on the ecology of two varieties within *Eriogonum corymbosum* has been freely drawn upon, and whose assistance in an early part of this study may be noted below. Field work on this group has been supported both by private financing and by National Science Foundation grants to Dr. Arthur Cronquist of the New York Botanical Garden for the Inter-mountain Flora Project, a cooperative program between the New York Botanical Garden and Utah State University, and by the Texas Research Foundation. Critical herbarium material has been borrowed through the support of Brigham Young University. Herbarium visits which have been made during this study have been largely supported by Utah State University, the New York Botanical Garden, and the Smithsonian Research Foundation. In this latter case, I would like to thank Conrad V. Morton of the United States National Herbarium who not only assisted me in the preparation of the Latin descriptions, but also freely gave his advice on this and other subjects during a predoctoral internship program at the United States National Herbarium of the Smithsonian Institution from September 1966 to February 1967. This paper has been submitted to the Brigham Young University Botany Department as partial fulfillment of three credits of Doctoral Research given during the Fall Session of 1967-1968. I wish to thank Mrs. Twila Davis Bird whose excellent illustrations are seen below.

The following herbarium collections have been consulted, and to the several curators of herbaria that were visited or who sent loan material for this study, I am most grateful. The abbreviations follow Lanjouw & Stafleu (1964).

A	Arnold Arboretum, Harvard University, Cambridge, Massachusetts.
ARIZ	University of Arizona, Tucson, Arizona.
ASC	Northern Arizona University, Flagstaff, Arizona.
BM	British Museum of Natural History, London, England.
BR	Jardin Botanique de l'État, Bruxelles, Belgium.
BRY	Brigham Young University, Provo, Utah.
CAS	California Academy of Sciences, San Francisco, California.
COLO	University of Colorado, Boulder, Colorado.
DS	Dudley Herbarium, Stanford University, Stanford, California.
GH	Gray Herbarium, Harvard University, Cambridge, Massachusetts.
IDS	Idaho State University, Pocatello, Idaho.
ISC	Iowa State University, Ames, Iowa.
KSC	Kansas State University, Manhattan, Kansas.
LY	Laboratoire de Botanique de la Faculté des Sciences, Lyon, France.

MICH	University of Michigan, Ann Arbor, Michigan.
MO	Missouri Botanical Garden, St. Louis, Missouri.
MONTU	Montana State University, Missoula, Montana.
NY	New York Botanical Garden, Bronx Park, New York.
OKL	Bebb Herbarium, University of Oklahoma, Norman, Oklahoma.
ORE	University of Oregon, Eugene, Oregon.
OSC	Oregon State University, Corvallis, Oregon.
P	Museum National d'Histoire Naturelle, Laboratoire de Phanerogamie, Paris, France.
PH	Academy of Natural Sciences, Philadelphia, Pennsylvania.
POM	Pomona College Herbarium, Rancho Santa Ana Botanic Garden, Claremont, California.
RM	Rocky Mountain Herbarium, University of Wyoming, Laramie, Wyoming.
RSA	Rancho Santa Ana Botanic Garden, Claremont, California.
SD	San Diego Society of Natural History, San Diego, California.
TEX	University of Texas, Austin, Texas.
UC	University of California, Berkeley, California.
UNM	University of New Mexico, Albuquerque, New Mexico.
US	United States National Herbarium, Smithsonian Institution, Washington, D. C.
USFS	Forest Service Herbarium, United States Department of Agriculture, Washington, D. C.
UT	University of Utah, Salt Lake City, Utah.
UTC	Intermountain Herbarium, Utah State University, Logan, Utah.
WIS	University of Wisconsin, Madison, Wisconsin.
WS	Washington State University, Pullman, Washington.
WTU	University of Washington, Seattle, Washington.

TAXONOMY

- A. Leaf-apices sharply acute, the leaves mostly lanceolate, usually more than 3 cm long.
- B. Branches subglabrous to tomentose; involucre tomentose externally.
 - C. Involucres 2.5-3 mm long; inflorescences with several short branches; perianth white, 3-3.5 mm long, the calyx-segments \pm dissimilar; leaves 3-5 cm long, the petioles 3-6 mm long, deciduous on the lower parts of the stems; Mancos Shale east of Wellington, Carbon Co., Utah.
 - 1. *E. lancifolium*
 - CC. Involucres 3-4 mm long; inflorescences open with few long branches; basal stem leaves usually persistent.
 - D. Involucres 3.5-4 mm long; perianth white, 3.5-4.5 mm long, the calyx-segments \pm dissimilar; leaves 3.5-7 cm long, the petioles 5-10 (18) mm long; Bad Land Cliffs, Duchesne Co., Utah.
 - 2. *E. hylophilum*
 - DD. Involucres 3-3.5 mm long; perianth yellow, 2.5-3 mm long, the calyx-

segments similar or nearly so; leaves 2.5-4 cm long, the petioles 4-7 mm long; Indian Creek Canyon, Duchesne Co., Utah. 3. *E. duchesnense*

BB. Branches glabrous or floccose; involucre glabrous externally.

C. Leaves tomentose below.

D. Involucre 2-3 mm long; perianth cream to pale yellowish-white, 2-3 mm long, the calyx-segments oblanceolate; inflorescences 1-2 dm long; Dinosaur National Monument area, Uintah Co., Utah. 4. *E. saurinum*

DD. Involucre 2.5-3.5 (4) mm long; perianth white, 2.5-3.5 (4) mm long, the calyx-segments elliptic to oblong; inflorescences up to 1 dm long; southern Colorado and adjacent New Mexico and Texas.

5. *E. fendlerianum*

CC. Leaves as well as the entire plant glabrous throughout; perianth yellow, 3-4 mm long; San Rafael Desert, Emery Co., Utah.

6. *E. smithii*

AA. Leaf-apices mostly rounded, the leaves oblanceolate to lanceolate or elliptic to nearly orbicular, 1-3 (4.5) cm long; southwestern Wyoming and western Colorado to Utah, south to northern Arizona and northwestern New Mexico.

7. *E. corymbosum*

1. *Eriogonum lancifolium* Reveal & Brotherson, spec. nov.

Fruticulus 3.5-5 dm altus, erectus; caules basi per 1.5-3 dm foliosi vel nudi per 5-10 cm; laminae foliorum lanceolatae, 3-5 cm longae, 0.5-1 cm latae, \pm revolutae, subtus albo-tomentosae, supra subglabrae et virides, petiolis brevibus, 3-6 mm longis, basi expansa petioli 2 mm lata, tomentosa; caules deorsum tomentosa, sursum subglabri vel parce tomentosi, bracteis 1.5-3 mm longis, linearibus; inflorescentiae ex fasciculis confertis ramulorum erectorum compositae, 6-14 cm longae, subglabrae; involucre turbinata, 2.5-3 mm longa, 1.5-2 mm lata, sessilia, extra tomentosa, intus glabra, 5-lobata, bracteolis oblanceolatis, 1.5-2 mm longis, pedicellis 3-4 mm longis, glabris; perianthia alba, costa brunnea. (2.5) 3-3.5 mm longa, segmentis subimilibus, exterioribus spatulatis, 3-3.5 mm longis, 1-1.3 mm latis, apice truncato, interioribus oblanceolatis, 2.5-3 mm longis, 0.3-0.6 mm latis; stamina 1.5-4.5 mm longa, filamentis basi glabris, antheris 0.3-0.4 mm longis, oblongis; achaenia brunnea, 2 mm longa.

Shrubby perennials, 3.5-5 dm high, forming densely branched, erect crowns from woody caudices; leaves on the lower half of the

plants, the lowest most often deciduous so that the first leaves are 5-10 cm up the stems, leaf-blades lanceolate, 3-5 cm long, 0.5-1 cm wide, entire or \pm crenulate, revolute in some, densely white-tomentose below, less so to subglabrous and green above, the petioles short, 3-6 mm long, floccose-tomentose, the expanding petiole-bases 2 mm wide, subglabrous to sparsely tomentose externally, tomentose internally; lower stems densely tomentose, the branches becoming subglabrous or sparsely tomentose above, 5-12 cm long; bracts ternate, scalelike, 1.5-3 mm long, linear, widening from the acute apices to connate bases, glabrous or subglabrous externally, tomentose internally; inflorescences dense clusters of short, erect, trichotomous, subglabrous branches, 6-14 cm long; involucre sessile, turbinate, 2.5-3 mm long, 1.5-2 mm wide, tomentose externally, glabrous internally, the 5 acute teeth $\frac{1}{4}$ the length of the tubes, the bractlets narrowly oblanceolate, 1.5-2 mm long with minute capitate marginal cells, the pedicels 3-4 mm long, glabrous; perianth white with brownish (greenish at first) midribs and bases, the outer whorl of segments spatulate with truncate apices, 3-3.5 mm long, 1-1.3 mm wide, the inner segments narrowly oblanceolate, 2.5-3 mm long, 0.3-0.6 mm wide; stamens exserted, 1.5-4.5 mm long, the filaments glabrous at the bases, the anthers 0.3-0.4 mm long, oblong, yellowish-white to reddish; achenes brown, 2 mm long, the ovoid bases gradually tapering to 3-angled beaks. Figure 1.

TYPE. UTAH: Carbon Co. On low, rolling Mancos Shale hills 5 mi E of Wellington, 9 Sep 1967, *James L. Reveal & Gerrit Davidse* 957. Holotype deposited at UTC. Isotypes distributed to ARIZ, BRY, CAS, DS, GH, MO, NY, RM, RSA, UC, US, and other herbaria.

DISTRIBUTION. Known only from the Mancos Shale hills 3-6 miles east of Wellington and 5.5 miles south of Wellington, Carbon Co., Utah. Map 1. Flowering mainly from August to September.

SPECIMENS EXAMINED. UTAH: Carbon Co., Near Price, *Flowers in 1926* (NY, UT), *in 1927* (BRY, UT, UTC), *in 1928* (BRY, SD, UT); Price, *M. E. Jones 6512* (BM, MO, POM, US); 5 mi E of Wellington, *Moore 661* (BRY, NY, UTC); Price, *S. Stokes s.n.* (UC); 5.5 mi S of Wellington, *Reveal & Davidse 955* (BRY, NY, UTC); 5 mi E of Wellington, *Reveal & Reveal 727* (BRY, NY, UTC); 3 mi E of Wellington, *VanCott & Larsen 87* (UTC); 5 mi E of Wellington, *Welsh & Moore 1836* (BRY, ISC).

This population was first called to my attention by Dr. Stanley L. Welsh of Brigham Young University in 1965. Later, as this study began, a few specimens were seen from the Price-Wellington area that agreed with the Welsh & Moore collection that had been seen before. With the assistance of Brotherson, detailed herbarium studies were carried out in the spring of 1966 which were then followed by field work in 1966 and 1967.

From the herbarium studies, we quickly realized that other taxonomists before us had considered this population to be of some interest. Dr. Seville Flowers of the University of Utah had collected a large series of specimens over a period of three years for study by Stokes. Although both Jones and Stokes had collected the species before, their material was rather limited.

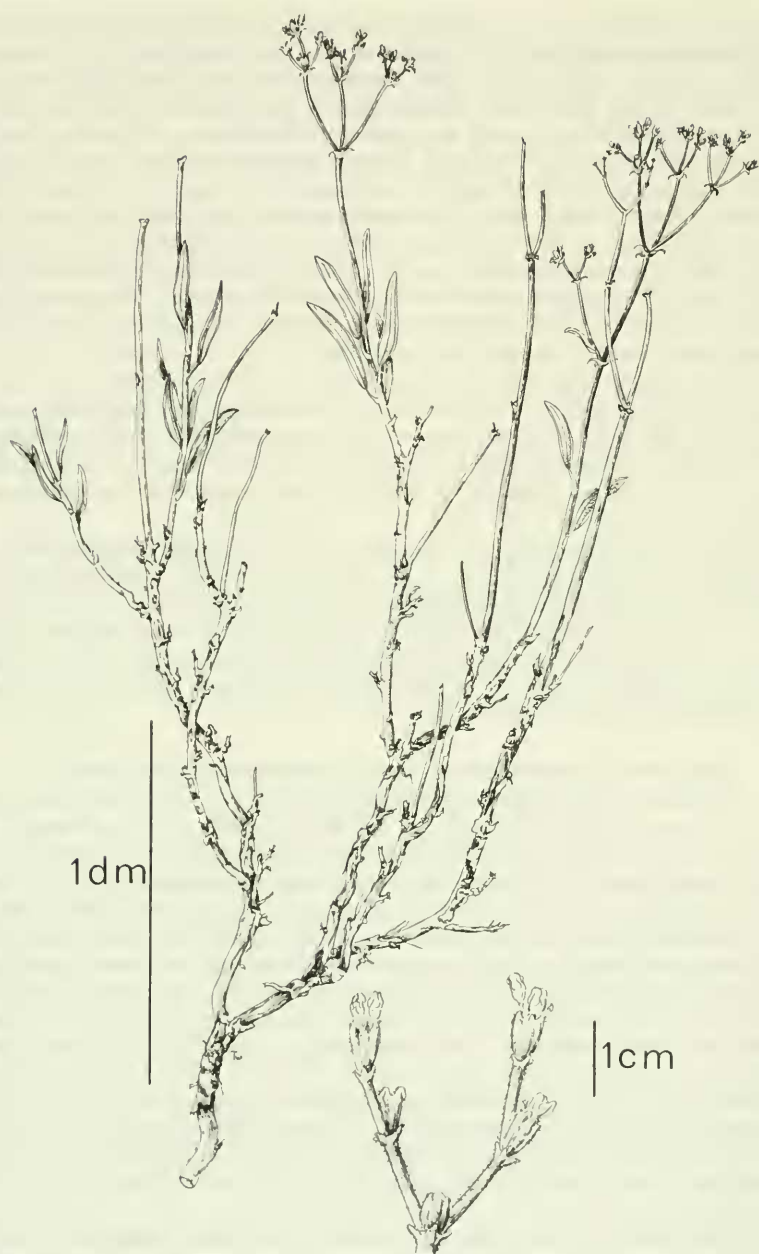


Fig. 1. Habit sketch of *Eriogonum lancifolium* showing the general aspect of the species and a single enlarged segment of the inflorescence with involucre and exserted flowers.

One of the more interesting features of this plant and some of the other members in the complex is the fact that the lower leaves on the stems are deciduous. This condition of early leaf fall gives the plants a rather bare look. In the fall of the year, wilted leaves may be seen as well as the old expanded petiole-bases. However, in the spring, the branches that had leaves the year before were found to lack leaf buds. Also, it should be pointed out that the leaves on this species tend to vary with the conditions of the year. In poor years the leaves tend to be longer and narrower and decidedly more acute, and the inflorescences are not as densely branched. Thus the type collection cited above which was collected in a good year has a large, dense inflorescence with somewhat shorter leaves than most of the specimens cited in the list of exsiccatae.

On most of the early collections, the location data were given simply as "Price" or "Near Price." Attempts to find this species near the Price area have been without success, and it is thus suggested that all of the collections came from the Wellington area, and the use of "Price" was simply to indicate the largest city in this general area.

The relationship of *E. lancifolium* to the other members of the complex is not certain. Its most closely related species seems to be *E. saurinum*, but the pubescence is not at all similar. At the same time, the Wellington Buckwheat approaches *E. hylophilum* in the branching pattern of the basal portions of the plants, but the inflorescences differ, and *E. hylophilum* has leaves which are shaped differently and not deciduous.

2. *Eriogonum hylophilum* Reveal & Brotherson, spec. nov.

Fruticulus 2.5-4 dm altus; caules basi per 1-1.5 dm foliosi; laminae foliorum lineari-lanceolatae vel lanceolatae, 3.5-7 cm longae, 3-6 (8) mm latae, subtus albo-tomentosae, supra viridi-tomentosae, petiolis longis, 5-10 (18) mm longis, basi expansa petioli 2-3 (3.5) mm lata, tomentosa; caules ubique tomentosi, 1-2.5 dm longi, bracteis superioribus 2-3 mm longis, inferioribus \pm foliaceis, 3-20 mm longis; inflorescentiae ex fasciculis nonnullis brevibus densis ramulorum compositae, tomentosae, 3-8 cm longae; involucra turbinata, 3.5-4 mm longa, 2.5-3 mm lata, extra tomentosa, intus glabra, 5-6 lobata, bracteolis oblanceolatis, 3.5-5 mm longis, pedicellis 3.5-5 mm longis, glabris; perianthia alba, costa viridi, (3) 3.5-4 (4.5) mm longa, extra glabra, intus minute glandulosa, segmentis subsimilibus, exterioribus spathulatis, 1.3-1.7 (2) mm latis, interioribus oblanceolatis, 0.6-0.9 (1.2) mm latis; stamina 2-3 (3.5) mm longa, filamentis basi pilosis, antheris 0.3-0.5 mm longis, oblongis; achaenia brunnea, 2.5-3 mm longa.

Subshrubby perennials, 2.5-4 dm high, forming open, branched and erect crowns from woody caudices; leaves on the lower fourth of the plants, persistent, linear-lanceolate to lanceolate, 3.5-7 cm long, 3-6 (8) mm wide, densely white-tomentose below, less so and green above, the margins entire and \pm revolute or rarely crenulate, the

petioles long, 5-10 (18) mm long, tomentose, the expanding petiole-bases 2-3 (3.5) mm wide, tomentose on both surfaces; stems tomentose, 1-2.5 dm long; bracts ternate, scalelike and triangular above, 2-3 mm long, becoming \pm foliaceous and up to 2 cm long below, widening from acute apices to connate bases; inflorescences open, the branches short and stout, 3-8 cm long, tomentose; involucre sessile with 1-3 per node, turbinate, 3.5-4 mm long, 2.5-3 mm wide, tomentose externally, glabrous internally, the 5-6-lobes less than $\frac{1}{4}$ the length of the tubes, the bractlets oblanceolate, 3.5-5 mm long, hirsutulous with long marginal cells, the pedicels 3.5-5 mm long, glabrous; perianth white with greenish midribs, (3) 3.5-4 (4.5) mm long, glabrous without, minutely glandular along the midribs within, the calyx-segments \pm dissimilar, the outer whorl of segments spatulate with acute apices, 1.3-1.7 (2) mm wide, the inner segments oblanceolate, 0.6-0.9 (1.2) mm wide; stamens included, 2-3 (3.5) mm long, the filaments pilose basally, the anthers greenish-white, 0.3-0.5 mm long, oblong; achenes brown, 2.5-3 mm long, the ovoid bases tapering to 3-angled, retrorsely roughened, beaks. Figure 2.

TYPE. UTAH: Duchesne Co. Along Utah highway 53 (the Wellington-Myton Road) in Gate Canyon, 2.7 mi SW of the summit of the Bad Land Cliffs, Sec. 20, T. 11 S., R. 15 E., elevation 6500 feet, 15 Aug 1966, *Noel H. Holmgren & James L. Reveal 3017*. Holotype deposited at UTC. Isotypes distributed to ARIZ, BRY, CAS, DS, GH, MO, NY, RM, RSA, UC, US, and other herbaria.

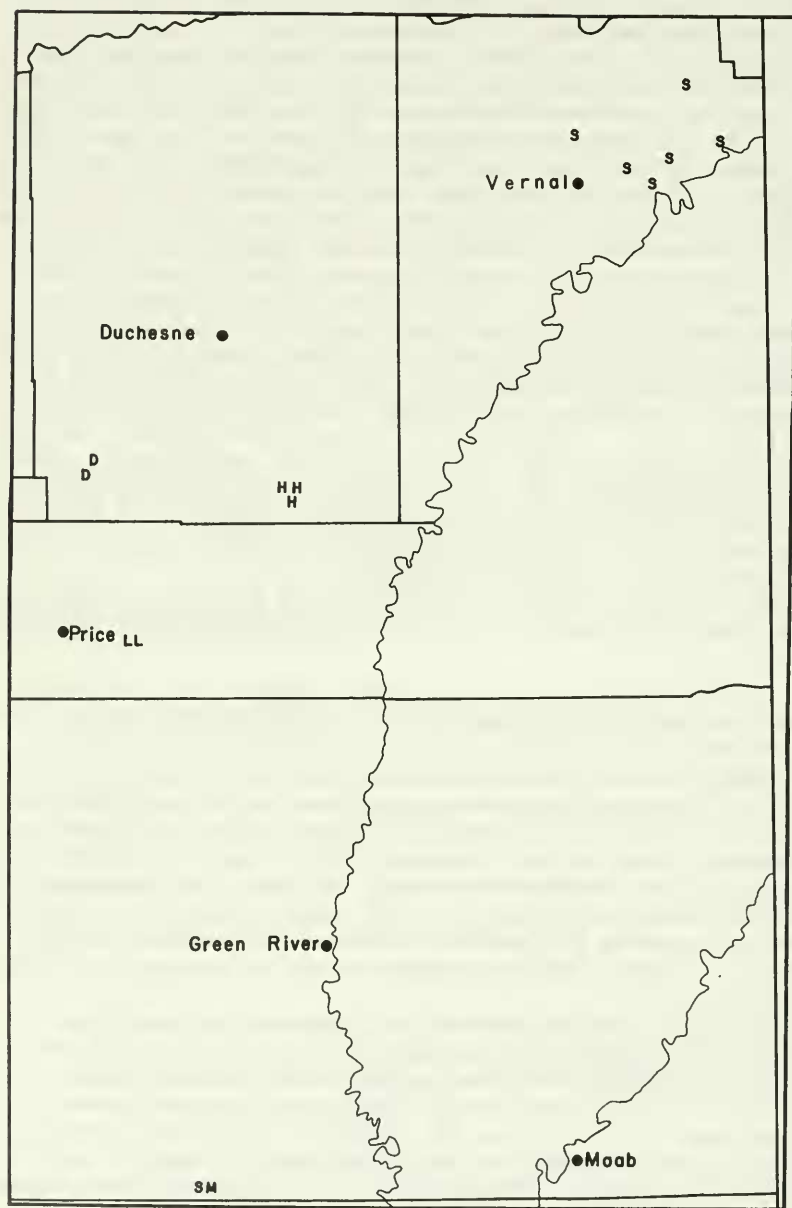
DISTRIBUTION. Locally common on the Bad Land Cliffs near Gate Canyon, Duchesne Co., Utah. Map 1. Flowering from late July to September.

SPECIMENS EXAMINED. UTAH: Duchesne Co., Summit of the Bad Land Cliffs, along Utah highway 53, *Holmgren, Reveal, & LaFrance 2386* (ARIZ, BRY, CAS, DS, GH, KANS, MO, NY, OKL, OSC, RM, RSA, UC, US, UT, UTC, WIS).

This distinctive species has apparently gone unnoticed by the several taxonomists who have passed over the summit of the road between Wellington and Myton. Actually, as far as *Eriogonum* is concerned, several of the late season entities are poorly known, and suspecting that a large and relatively unknown flora might exist in the Intermountain Region in the fall, several collecting trips have been made during this period. As this paper and others (Reveal, in press a, b) demonstrate, the rewards from this late season collecting have been rich.

Eriogonum hylophilum was first discovered in 1965, but at that time it was thought to be *E. corymbosum*. As the nature of *E. corymbosum* was determined, it was possible to see that this material from the Bad Land Cliffs was distinct. The population extends nearly five miles down Gate Canyon on the Wellington side of the summit, but less than half of a mile on the Myton side. Toward the west, the species was found to extend less than a mile, but its eastward limits have not been determined.

In Gate Canyon, *E. hylophilum* occurs as scattered plants on *Artemisia* hillsides in the Pinyon-Juniper belt. The species is com-



Map 1. Distribution in eastern Utah of *Eriogonum lancifolium* (L); *E. hylophilum* (H); *E. duchesnense* (D); *E. saurinum* (S); and *E. smithii* (SM).

monly found with *E. corymbosum* var. *erectum*, and in the field, the two are easily distinguished. However, the separation of *E. hylophilum* and *E. lancifolium* is not as readily apparent, especially in the herbarium. These two differ in several technical characteristics such as perianth size and shape, involucre characters, and the nature of the inflorescences and growth patterns, yet they seem to be rather

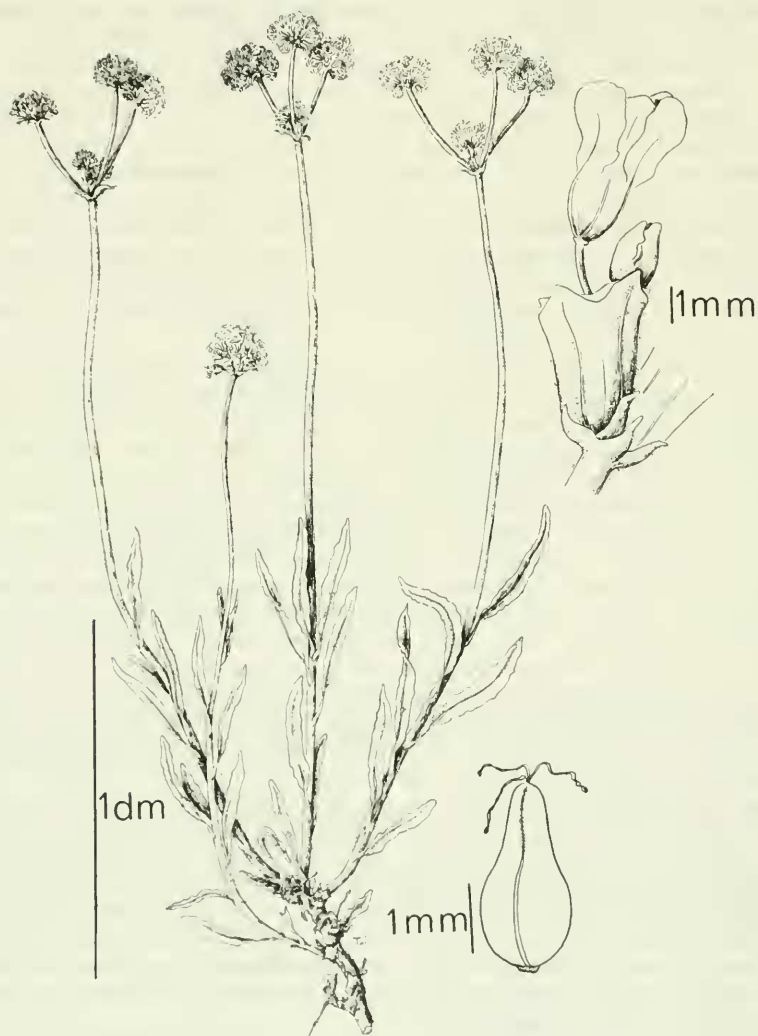


Fig. 2. Habit sketch of *Eriogonum hylophilum* showing the generally stout erect stems and the capitate or short-rayed inflorescences of clustered involucre, with an enlarged involucre and flowers, and of a single achene.

closely related. Actually however, the species that is probably most closely related to *E. hylophilum* is *E. duchesnense*.

3. *Eriogonum duchesnense* Reveal, spec. nov.

Fruticulus 2-3.5 dm altus; caules basi per 1-1.5 dm foliosi; laminae foliorum lanceolatae vel spathulatae, 2.5-4 cm longae, 0.5-1 cm latae, subtus albo-tomentosae, supra subglabrae et virides, petiolis brevibus, 4-7 mm longis, basi expansa petioli 2 mm lata, extra tomentosa, intus subglabra vel glabra; caules deorsum tomentosi, ramis 1-1.5 dm longis; bracteae foliaceae, 3-10 mm longae, lineares vel lanceolatae, tomentosae; inflorescentiae ex fasciculis nonnullis brevibus densis ramulorum compositae, tomentosae, (3) 5-10 cm longae; involucria turbinata, 3-3.5 mm longa, 2-2.5 mm lata, sessilia, extra tomentosa, intus glabra, 5-lobata, bracteolis oblanceolatis, 2-2.5 mm longis, pedicellis 3-4.5 mm longis, glabris; perianthia flava, 2.5-3 mm longa, extra glabra, intus minute pilosa vel glandulosa, segmentis subsimilibus, elongato-obcordatis vel oblanceolatis, exterioribus 1.5 mm latis, interioribus 1-1.3 mm latis; stamina 1.5-2 mm longa, filamentis basi pilosis, antheris 0.3-0.4 mm longis, oblongis; achaenia brunnea, 2-3 mm longa.

Subshrubby perennials, 2-3.5 dm high, forming open crowns from woody caudices; leaves on the lower third of the plant, persistent, lanceolate to spathulate, 2.5-4 cm long, 0.5-1 cm wide, densely white-tomentose below, subglabrous and green above, the petioles short, 4-7 mm long, subglabrous, the petiole-bases 2 mm wide, tomentose to subglabrous externally, subglabrous to glabrous internally; branches tomentose, densely so among the leaves, less so above, the branches 1-1.5 dm long; bracts ternate, \pm foliaceous, 3-10 mm long, linear to lanceolate, widening from the acute apices to connate bases, tomentose within and without; inflorescences open and compoundly divided, the short, stout branches rather clustered, tomentose, (3) 5-10 cm long; involucries sessile with 1-3 per node, turbinate, 3-3.5 mm long, 2-2.5 mm wide, tomentose externally, glabrous internally, the 5 acute teeth nearly $\frac{1}{2}$ the length of the tubes, the bractlets oblanceolate, 2-2.5 mm long, hirsutulous with numerous long marginal cells, the pedicels 3-4.5 mm long, glabrous; perianth yellow, 2.5-3 mm long, glabrous without, with few scattered hyaline hairs or minute glands within, the calyx-segments \pm similar, the outer whorl of segments elongate-obcordate, 1.5 mm wide, the inner segments slightly narrower, 1-1.3 mm wide; stamens included, 1.5-2 mm long, the filaments pilose basally, the anthers 0.3-0.4 mm long, greenish-yellow, oblong; achenes brown, 2-3 mm long, the ovoid bases tapering to short 3-angled beaks, ridged with the distinct margins extending down the entire length of the fruit, roughened with retrorse hairs along the margins. Figure 3.

TYPE. UTAH: Duchesne Co. Ca. 24 mi SW of Duchesne along Utah highway 33, in Indian Creek Canyon, 0.7 mi below the Indian Creek Canyon Guard Station on steep clay banks, sec. 28, T. 10 S., R. 7 W., elevation 7800 feet, 2 Sep 1964, *James L. Reveal* 678. Holotype

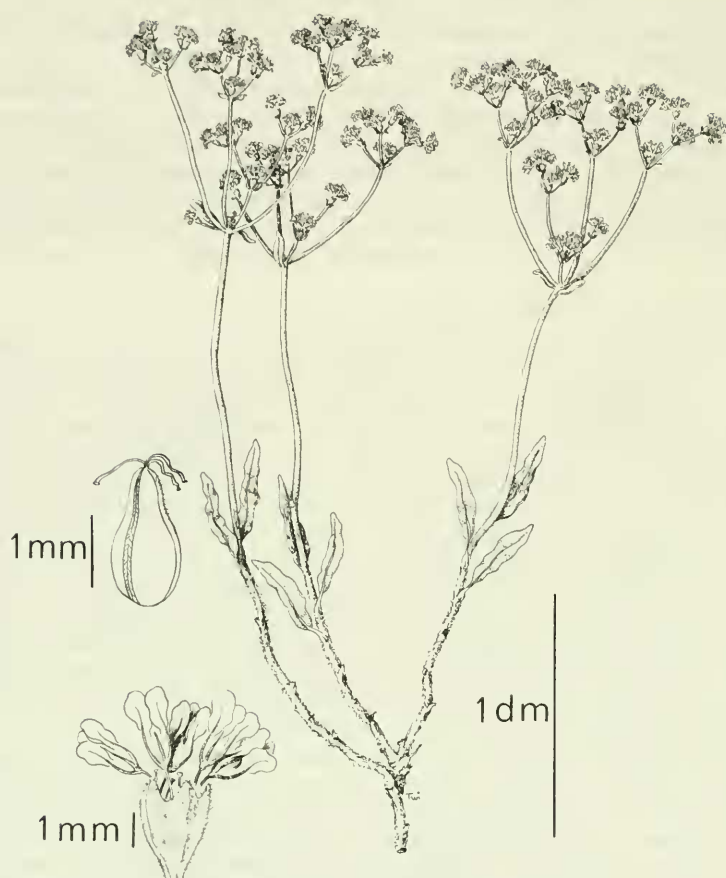


Fig. 3. Habit sketch of *Eriogonum duchesnense* showing the erect stems and compound inflorescences with a single enlarged involucre with several flowers and a single involucre.

deposited at UTC. Isotypes distributed to ARIZ, BRY, CAS, DS, GH, MO, NY, RM, RSA, UC, US, and other herbaria.

DISTRIBUTION. Infrequent and rare in Indian Creek Canyon, Duchesne Co., Utah. Map 1. Flowering mainly in August and September.

SPECIMENS EXAMINED. UTAH: Duchesne Co., 5 mi N of the summit of Indian Creek Canyon, *Maguire & Richards 13287* (GH, UC, UTC).

Eriogonum duchesnense has been a puzzling plant to study. When this species was first discovered by me a large collection was made, photographs taken, and its distribution in the canyon was studied. However, since 1964, the State of Utah has rebuilt the upper part of the highway in the canyon, and for the past three years not a

single plant has been found. Thus, the description of the entity is based on the material collected by Maguire and Richards, and on the type collection.

This species seems to be most closely related to *E. hylophilum*, from which it may have been derived. As noted in the key, the two differ in several characteristics of the involucre, calyx-segments, and leaves. Yet, the two are rather similar in habit, growth patterns, and ecology, although when comparing the various collections in the herbarium, these similarities are lost. The most readily discernible feature separating the two species is the flower color.

4. *Eriogonum saurinum* Reveal, spec. nov.

Fruticulus 3-5 dm altus; caules basi per 1-1.5 dm foliosi vel nudi per 5-10 cm; laminae foliorum lanceolatae, 3-6 cm longae, 4-8 mm latae, subtus albo-tomentosae, supra subglabrae et virides, petiolis 5-10 mm longis, basi expansa petioli 2-2.5 mm lata, tomentosa; caules ubique glabri, (1.5) 2-3.5 dm longi, bracteis superioribus 1 mm longis, linearis, inferioribus foliaceis, 1-3 cm longis; inflorescentiae ex fasciculis apertis ramulorum expansorum compositae, 1-2 dm longae; involucre turbinata, 2-3 mm longa, 1.5-2 mm lata, subsessilia vel sessilia, glabra, 5-lobata, bracteolis linearis, 2-3 mm longis, pedicellis 2.5-3.5 mm longis, glabris; perianthia eburnea, costa brunnescentia, 2-3 mm longa, segmentis subsimilibus, exterioribus oblanceolatis, 3-3.5 mm longis, 0.7-0.9 mm latis, apice rotundo, interioribus anguste oblanceolatis, 2.5-3 mm longis, 0.5-0.7 mm latis; stamina 2.5-4 mm longa, filamentis basi pilosis, antheris 0.3-0.4 mm longis, flavis; achaenia brunnea, 2.5-3 mm longa.

Shrubby perennials, 3-5 dm high with open and spreading crowns from branching woody caudices; leaves on the lower half of the plants, these often becoming deciduous on the lower 5-10 cm of the stems, the leaf-blades 3-6 cm long, 4-8 mm wide, lanceolate, densely white-tomentose below, subglabrous and green above, the petioles 5-10 mm long, floccose-tomentose, the petioles bases 2-2.5 mm wide, tomentose on both surfaces; lower stems tomentose only among the leaves, becoming green and glabrous above, (1.5) 2-3.5 dm long; bracts ternate, scalelike and 1 mm long above, becoming foliaceous and up to 3 cm long below, these similar to the leaves and usually only at the first node, the acute apices widening to connate bases, glabrous externally, tomentose internally; inflorescences cymose, spreading, the open branches mostly trichotomous, 1-2 dm long; involucre sessile or subsessile, not clustered, turbinate, 2-3 mm long, 1.5-2 mm wide, glabrous, the 5 acute lobes less than $\frac{1}{4}$ the length of the tubes, the bractlets linear, 2-3 mm long, the pedicels 2.5-3.5 mm long, glabrous; perianth cream-white to pale yellowish-white with light tan midribs and bases, 2-3 mm long, glabrous except for minute glandular hairs within along the midribs, the calyx-segments \pm similar, the outer whorl of segments oblanceolate with rounded apices, 3-3.5 mm long, 0.7-0.9 mm wide, the inner segments narrower and shorter, 2.5-3 mm long, 0.5-0.7 mm wide; stamens 2.5-4 mm long,

the filaments pilose basally, the anthers 0.3-0.4 mm long, pale yellow; achenes light brown, 2.5-3 mm long, the subglobose bases tapering to 3-angled beaks. Figure 4.

TYPE. UTAH: Uintah Co. Along the Island Park Road, 10 mi E of Vernal along Brush Creek on steep hillsides on the ridges of Mowry Shale, sec. 1, T. 1 N., R. 22 E., elevation 5200 feet, 15 Aug 1966, Noel H. Holmgren & James L. Reveal 3019. Holotype deposited at UTC. Isotypes distributed to ARIZ, BRY, CAS, DS, GH, MO, NY, RM, RSA, UC, US, and other herbaria.

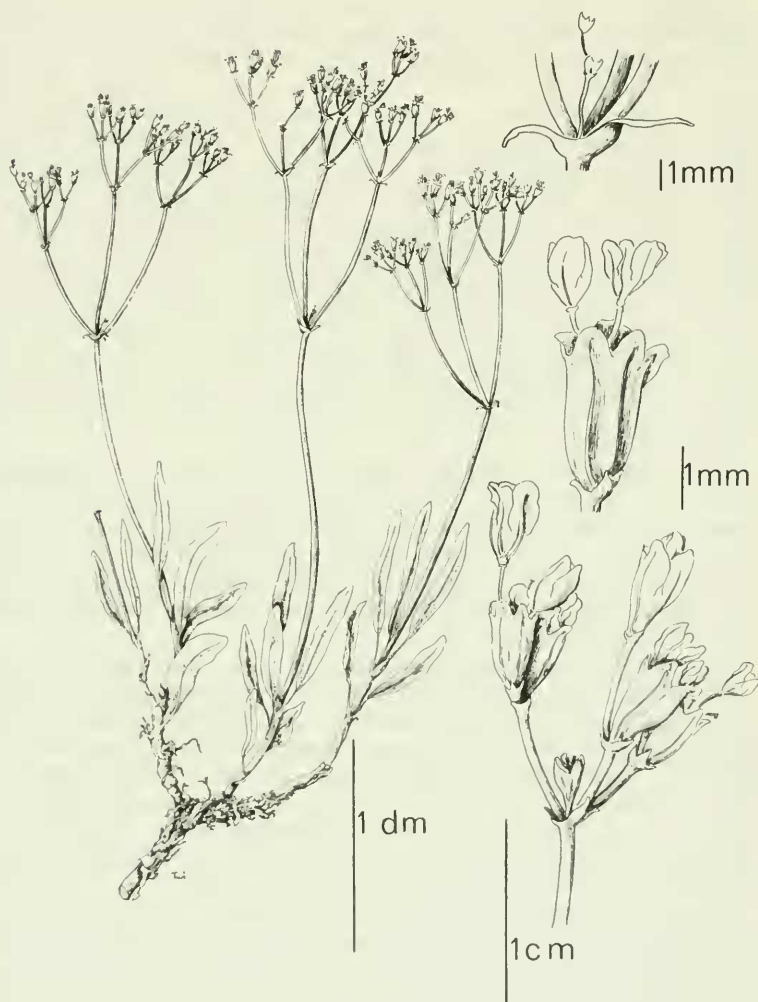


Fig. 4. Habit sketch of *Eriogonum saurinum* showing the general aspect of the species with enlarged drawings of the inflorescence, a single involucre with two exserted flowers, and the bracts subtending the inflorescence.

DISTRIBUTION. Locally common in the Dinosaur National Monument area where it is highly restricted to the narrow band of Mowry Shale, Uintah Co., Utah. Map 1. Flowering from late July to September.

SPECIMENS EXAMINED. UTAH: Uintah Co., Diamond Valley, *Andrews & Noble s.n.* (UTC); 6.5 mi N of Vernal, near Steinaker Res., *Reveal 674* (ARIZ, BRY, CAS, DS, GH, KANS, MO, NY, OKL, OSC, RM, RSA, TEX, UC, US, UT, UTC, WIS); near Dinosaur N. M., *Welsh 366* (BRY); Island Park, *Welsh 517* (BRY, UTC); between Island Park and Vernal, *Wolf & Dever 5261* (UTC).

Eriogonum saurinum is an unusual species from an ecological standpoint. Throughout the area surrounding the Dinosaur National Monument as well as in the Monument itself, there is a narrow, often upright, band of acidic Mowry Shale which has a pH often less than 5 (Hanson, 1962; Brotherson, 1967). On the soil derived from the Mowry Shale, as well as the band itself, *E. saurinum* is found. When standing on some prominence, it is possible to see this resistant shale standing out as it often forms the backbones of the low hills. On these hills, and especially along their ridges, *E. saurinum* is abundant. In fact, when one views the ridges from the side, they appear frilled with the green branches of the *Eriogonum*. When the Mowry Shale is not exposed, the buckwheat is missing. The Dinosaur Buckwheat is rarely more than 10 feet away from the shale. Those plants which grow along side the layer are not as robust as those closer or directly upon the shale. Welsh (1957) made several observations on the occurrence of this plant, as did Brotherson (per. comm.), and they both confirm the strict adherence of this species to Mowry Shale.

In the Dinosaur National Monument, endemics are not unusual (Welsh & Christensen, 1957; Holmgren, 1962). One of the more interesting of the endemics is *Astragalus chloöides* Barneby. In many respects the genus *Astragalus* is similar to *Eriogonum* in its features of endemism. Like *E. saurinum*, *A. chloöides* is highly restricted to a single formation (Entrada Sandstone) and has not been found off of this specific soil type.

For several years, *E. saurinum* has been incorrectly called *E. lonchophyllum* Torr. & Gray. However, this latter species is known only from northern New Mexico and southern Colorado, and is actually a member of the section associated with *E. brevicaulis* Nutt. The two species differ in several characteristics. The leaves of both species are lanceolate, but those of *E. saurinum* are less than 6 cm long, while the leaves of *E. lonchophyllum* often range from 5-10 cm long. The involucre and perianth of *E. lonchophyllum* are both 3-4 mm long, while those of *E. saurinum* are only 2-3 mm long.

The distinction between *E. saurinum* and *E. corymbosum* is most striking in the field. As Brotherson (1967) has shown, they occupy two different soil types, with *E. saurinum* being on the acid soils and *E. corymbosum* normally on the basic soils, with notable exceptions (Welsh 1957). In the herbarium, the two may be distinguished by the glabrous stems and open, few branched crowns of *E. saurinum*,

while the other species is tomentose and the crowns are decidedly more densely branched.

5. *Eriogonum fendlerianum* (Benth. in DC.) Small, Bull. Torrey Bot. Club 33: 55. 1906.

E. microthecum Nutt. var. ? *fendlerianum* Benth. in DC., Prodr. 14: 18. 1856. *E. effusum* Nutt. ssp. *fendlerianum* S. Stokes, Gen. Eriog. 79. 1936. *E. corymbosum* Benth. in DC. var. *fendlerianum* attributed to S. Wats. by S. Stokes, Gen. Eriog. 79. 1936, in synonymy.

E. ainslei Woot. & Standl., Contr. U. S. Nat. Herb. 16: 117. 1913. *E. effusum* Nutt. ssp. *ainslei* S. Stokes, Gen. Eriog. 79. 1936. (TYPE: Cimarron, Colfax Co., New Mexico. 20 Sep 1909. *C. N. Ainslie s n.* Holotype: us! Isotypes: us!)

Subshrubby to shrubby perennials, (1) 1.5-4 (5) dm high, forming open and spreading crowns of few to several branches from woody caudices; leaves on the lower half to two-thirds of the plants, the leaf-blades lanceolate to elliptic, 1.5-4 (5) cm long, (0.3) 0.5-2 cm wide, entire or crenulate along the margins, densely white-tomentose below, subglabrous to glabrous and green above, the petioles long, 5-20 mm long, subglabrous on the upper surface, tomentose on the lower surface, revolute, the expanding petiole-bases 2-3 mm wide, glabrous or tomentose externally, tomentose internally; lower stems densely tomentose among the leaves, the branches becoming glabrous or rarely floccose above, 3-15 (20) cm long; bracts ternate, mostly scalelike, 1-2.5 mm long, linear, widening from acute apices to connate bases, glabrous or subglabrous without, densely tomentose within; inflorescences open, mostly trichotomous, 2-10 cm long; involucre sessile, peduncled in the forks of the branches 1-7 mm long, involucre turbinate to turbinate-campanulate, 2.5-3.5 (4) mm long, 1.5-3.5 mm wide, glabrous or rarely subglabrous externally, often pilose at the throat of the tubes internally, becoming glabrous below, the 5 acute lobes less than $\frac{1}{4}$ the length of the tubes, the bractlets linear-ob lanceolate, 2-3 mm long, hirsutulous with minute marginal cells, the pedicels 3-4.5 (5) mm long, glabrous; perianth white with brownish midribs and bases, 2.5-3.5 (4) mm long, the calyx-segments similar or nearly so, the outer whorl of segments elliptical to oblong, the inner segments slightly narrower and shorter; stamens 2-4 mm long, the filaments pilose basally, the anthers 0.4-0.5 mm long, oblong; achenes brown, 2-2.5 mm long, the ovoid bases gradually tapering to 3-angled beaks. Figure 5.

TYPE. NEW MEXICO: Toas Co. Red River at Rock Creek, 1847. *Fendler 767*. Holotype deposited at GH! Isotypes: BM, GH, MO, NY!

DISTRIBUTION. Southwestern Colorado eastward to eastern Colorado and adjacent northeastern New Mexico, and (apparently) in western Texas. Map 2. Flowering from July to early September.

REPRESENTATIVE SPECIMENS. COLORADO: El Paso Co., Colorado Spr., *M. E. Jones s.n.* (US); Fountain, *Redfield 327* (NY). Fremont Co., Cañon City, *Brande-*

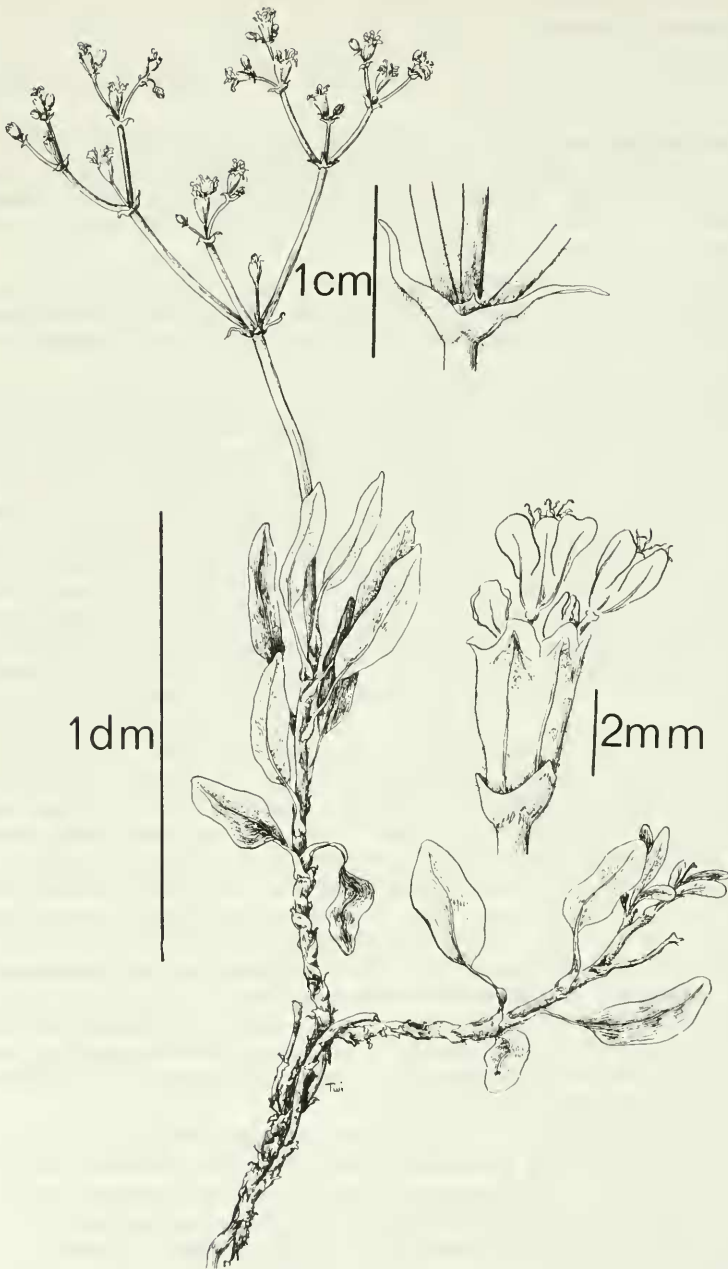


Fig. 5. Habit sketch of *Eriogonum fendlerianum* showing the stout stems and inflorescence with enlarged drawings of a single involucre with exserted flowers and the bracts subtending the inflorescence.



Map 2. Distribution of *Eriogonum fendlerianum*.

gee 327 (NY, UC); Cañon City, *M. E. Jones* 788 (BM, BR, CAS, NY, POM, US, UTC); 3 mi S of Florence, *Perland* 4621 (COLO); 6 mi E of Cañon City, *Reveal & Davidse* 871 (BRY, NY, UTC); 12 mi E of Cañon City, *Waterfall* 10868 (ARIZ, COLO, OKL, UTC). Las Animas Co., 10 mi SE of Trinidad, *Rollins* 1860 (DS, GH, MO, MONTU, NY, US, UTC, WS). Montezuma Co., Mancos, *Eastwood* in 1890 (COLO), in 1892 (MO, UC); North Rim of Mesa Verde, *Frauke* s.n. (RM); Mesa Verde, *Maguire* 12701 (NY, OKL, UTC). Montrose Co., 10 mi SW of Crawford, *Rollins* 1961 (DS, GH); Coventry, *Walker* 540 (GH, MO, NY, POM, US, WS). Otero Co., La Junta, *Rose & Fitch* 17165 (NY, US). Pueblo Co., Pueblo, *Greene* in 1874 (GH, ISC, NY, PH, US), in 1889 (UC); 18 mi W of Pueblo, *Waterfall* 10856 (ARIZ, COLO, OKL, UTC). San Miguel Co., 10 mi W of Telluride, *Maguire* 12775 (GH, UTC). NEW MEXICO: Colfax Co., Cimmaron, *Ainslie* s.n. (US); Raton Mts., *Bele* 50 (GH); near Raton, *Rose & Fitch* 17554 (NY, US); 6 mi SW of Raton, *Reveal & Davidse* 873 (BRY, NY, UTC); 12 mi SE of Raton, *Turner & Melchert* 4827 (TEX); 8 mi SE of Raton, *Waterfall* 12025 (OKL, TEX). Quay Co., Logan, *Fisher* 92 (MO, US). Rio Arriba Co., near Tierra Amarilla, *Wootton* s.n. (US). TEXAS: Without definite location. *Rammel* s.n. (US).

Eriogonum fendlerianum occurs in two forms, both of which have been named. The low, spreading form was named *E. ainslei* and is found mainly in southeastern Colorado and on the plains of northeastern New Mexico. To the west is the larger and somewhat more erect form which is represented by the type of *E. fendlerianum*. In southwestern Colorado, this kind of plant is at its extreme in stature. Nevertheless, in studying the plants in the field, these variants are easily bridged when intermediate geographical areas are visited. South of Raton, New Mexico, both forms may be seen growing together. At least in that area, the small form (*E. ainslei*), seems to be only younger plants of the larger form (*E. fendlerianum*). As I

can see no morphological grounds for maintaining both as species, *E. ainslei* is now reduced to synonymy.

In the Stokes treatment (1936), she recognized *E. effusum* Nutt. ssp. *salicinum* (Greene) S. Stokes as a form related to what is here called *E. fendlerianum*. However, in visiting the type area of *E. salicinum* at the Black Canyon of the Gunnison, it was found to be the same kind of plant that has been called *E. scoparium* Small. *Eriogonum salicinum*, which includes *E. scoparium* and possibly *E. tristictum* Small, seems to be closely related to *E. lonchophyllum* Torr. & Gray. However, this group of species is in need of considerable critical study.

Eriogonum fendlerianum is seemingly closely related to the more northern species described above, yet the exact nature of this suggested relationship, if any, has not been determined. From the aspect of gross morphology, this species resembles *E. saurinum*, mainly in the open crown, various features of the involucre and perianth, and usually in its ecology. At the present time, however, it seems that *E. fendlerianum* is actually closer to *E. corymbosum*, and the similarities with the Dinosaur Buckwheat are presently thought to be parallel rather than an indication of close relationship. The plants from the Mesa Verde area are exceedingly large and robust, and in the leaf features approaches certain specimens which are now tenuously assigned to *E. corymbosum* var. *orbiculatum* from southeastern Utah. The Reveal 687 from 15 miles south of the La Sal Junction resembles the Mesa Verde plants closely, but differs in the stem pubescence, and size of the involucre and perianth. The area from the La Sal Junction southeastward to the Mesa Verde has had little botanizing in the fall of the year, and until some detailed field observations of *E. fendlerianum* can be made, the several questions of relationships must remain unanswered.

6. *Eriogonum smithii* Reveal, spec. nov.

Fruticulus (3) 4-8 dm altus, omnino viridis et glabris; caules basi per 1.5-4 (5) dm foliosi; laminae foliorum ellipticae, 2.5-4.5 cm longae, 6-10 mm latae, \pm revolutae, petiolis 3-5 mm longis, basi expansa petioli 2.5-3.5 mm lata; bracteae 1-1.5 mm longae; inflorescentiae cymosae, 2-2.5 cm longae, \pm compactae; involucre turbinata (2.5) 3-3.5 mm longa, 2-2.5 mm lata, glabra margine ciliata excepta, 5-lobata, bracteolis lineari-oblancoelatis, 1.5-2.5 mm longis, pedicellis 3-3.5 mm longis; perianthia lutea, 3-4 mm longae, glabra, segmentis subsimilibus, exterioribus obovatis, 1.5-2 mm latis, interioribus oblancoelatis, 1-1.5 mm latis; stamina 2-5 (7) mm longa, filamentis basi pilosis, antheris flavis, 0.4-0.5 mm longis; achaenia brunnea. 3 mm longa.

Perennial shrubs, (3) 4-8 dm high and up to 2 m across, with many branches arising from woody caudices, the stems woody only at the base, becoming herbaceous above, the plants entirely glabrous throughout except for the axils of the leaves which bear the leaf-bud primordia, these sparsely pubescent; leaves decurrent and widely

separated along the lower $\frac{2}{3}$ of the plants, the lower leaves often deciduous so that the first leaves are 5-15 cm or more up the stems, the leaf-blades narrowly elliptical, 2.5-4.5 cm long, 6-10 mm wide, \pm revolute, the leaf-margins always thicker than the blades, bright green, the petioles short, 3-5 mm long with the expanding petiole-bases 2.5-3.5 mm wide, glabrous and brown or tan externally, densely or sparsely white-tomentose internally; bracts ternate, scalelike, 1-1.5 mm long, linear to triangular, the acute apices widening to connate bases; inflorescences open, cymose, mostly trichotomously branched throughout, 2-25 cm long, the branches short and somewhat compact, bright green; involucre sessile, turbinate, (2.5) 3-3.5 mm long, 2-2.5 mm wide, glabrous, finely ciliated in the throat in some, sharply angled with 5 acute teeth, these less than $\frac{1}{4}$ the length of the tubes, the lobes of the teeth often with membranaceous margins, the bract-lets 2 per pedicel, linear-oblongate, 1.5-2.5 mm long, hirsutulous with short acute marginal cells, the pedicels 3-3.5 mm long, glabrous; perianth yellow, 3-4 mm long, glabrous without, microscopically glandular along the midribs within, the calyx-segments subsimilar, the outer whorl of segments obovate, 1.5-2 mm wide, the inner segments oblanceolate, 1-1.5 mm wide; stamens 2-5 (7) mm long, the filaments pilose basally, the anthers yellow, 0.4-0.5 mm long, oblong; achenes brown, lance-ovoid, 3 mm long, the ovoid bases tapering to roughened 3-angled beaks. Figure 6.

TYPE. UTAH: Emery Co. On the east side of a low summit along a sandy desert road between Little Flat Top and Big Flat Top, San Rafael Desert, about 10 mi SE of Utah highway 24 from the turnoff which is 0.5 mi S of the Goblin Valley turnoff, sec. 22, T. 26 S., R. 13 E., elevation 5500 feet, 14 Aug 1966, Noel H. Holmgren & James L. Reveal 3012. Holotype deposited at UTC. Isotypes distributed to ARIZ, BRY, CAS, DS, GH, MO, NY, RM, RSA, UC, US, and other herbaria.

DISTRIBUTION. Known only from the north and east side of Big Flat Top and near Little Flat Top, San Rafael Desert, Emery Co., Utah. Map 1. Flowering from late July to September.

SPECIMENS EXAMINED. UTAH: Emery Co., E of Big Flat Top, Reveal & Davidse 950 (BRY, NY, UTC); N of Big Flat Top, Reveal & Davidse 951 (BRY, NY, UTC); between Big Flat Top and Little Flat Top, A. D. Smith s.n. (BRY, CAS, NY, UTC).

Eriogonum smithii can be instantly recognized by its bright green color, its bright yellow flowers, and its almost total lack of pubescence, the latter feature not found in any other perennial species in the genus. Its relationship to other species in the genus has been determined on the basis of its overall morphology. It is believed that *E. smithii* is related to *E. corymbosum*.

The site where the type of *E. smithii* was collected is in a small circular basin that is surrounded on two-thirds of its sides by steep red sandstone cliffs of the Summerville Formation. The remaining side is the edge of the San Rafael Desert which is composed of red Entrada "blowsand" in this area. In the basin, the plants occur mainly on the floor where there seems to be a high selenium content.

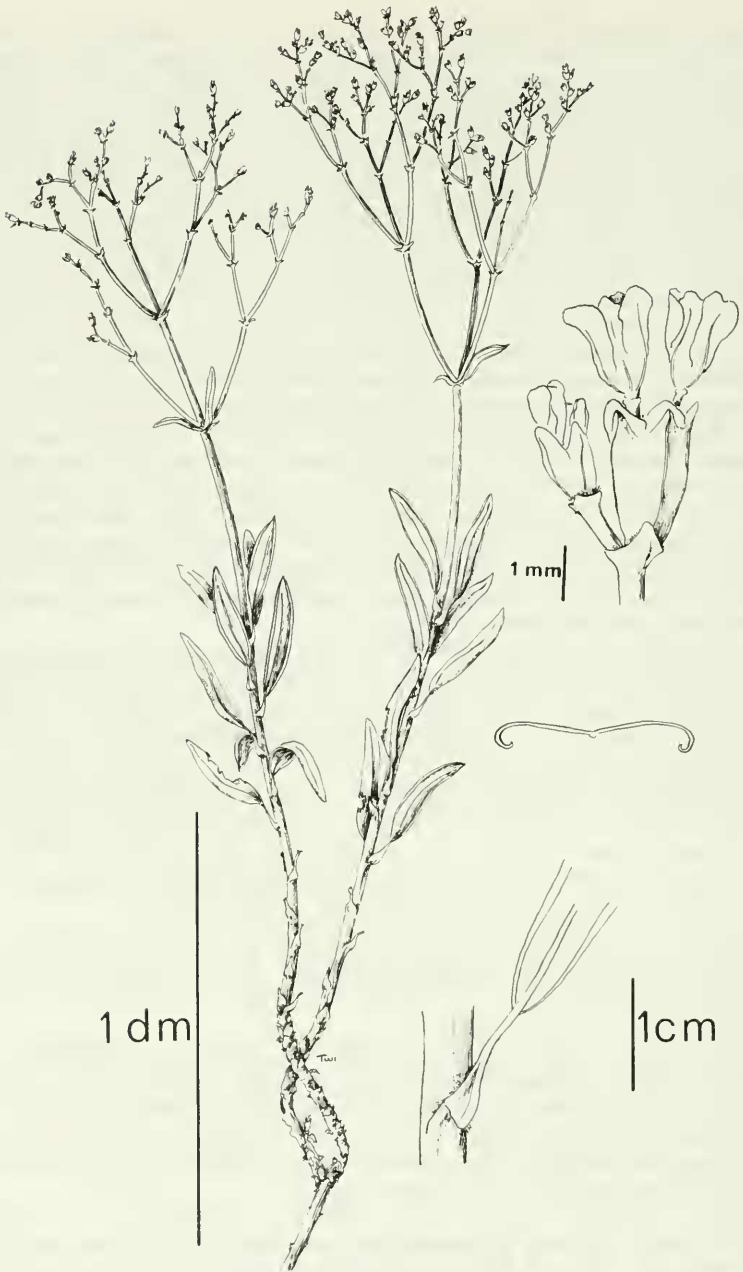


Fig. 6. Habit sketch of *Eriogonum smithii* showing the erect leaves and compound inflorescences with enlarged drawings of the petiole base, a cross section of a leaf, and involucres with exserted flowers.

However, the largest plants occupy the upper edges of the basin and especially so on the sandy desert floor east of Little Flat Top and thus north and east of Big Flat Top. In this area the plants are on the edges of small outwash areas where the infrequent rain water has formed small gullies and rivlets. Further to the east, on a small mesa east of Big Flat Top, the plants of *E. smithii* are much smaller and more sparsely branched than elsewhere. I have seen this species up to 5 miles east of Little Flat Top, but how much further to the east the species extends has not been determined.

The branching habit of *E. smithii* reflects most clearly the kind of branching habit found in this group. In the axis of one of the leaves is a stem bud. This bud is often one decimeter or more up the branch. In the spring, the bud produces a stem which in turn, of course, has a stem bud. However, as the stem buds are always below the inflorescence, the new stem with its greater weight causes the old stem to become nearly prone and thus widely spreading. The new stems are erect or only slightly spreading outwardly to conform with the overall shape of the bush. The old inflorescence, that is, the one produced the previous year, is now brown and dried and sticks out beyond the new stem. In *E. corybosum* var. *orbiculatum*, the old inflorescences may be easily seen. Thus, as the plants grow, the distance between the root and the flowering stems gradually increases. In the sandy areas particularly, the older stems and branches are buried in rounded mounds of sand.

It is a privilege to follow the suggestion of Arthur H. Holmgren, who called this plant to my attention, by naming this species in honor of Dr. Arthur D. Smith, professor in the Range Sciences Department and a member of the Utah State Fish and Game Department. Long recognized as an authority on range management practices in the western United States, he has been a diligent plant collector of Great Basin and Intermountain plants for over thirty years.

7. *Eriogonum corymbosum* Benth. in DC., Prodr. 14: 17. 1856.

Subshrubby and shrubby perennials, (2) 3-8 (12) dm high, forming erect to hemispherical crowns of few to many branches from branching, woody, caudices; leaves mainly on the lower half of the plants, often extending up to the base of the inflorescences, the leaf-blades oblanceolate to lanceolate or elliptic to nearly orbicular, 1-3 (4.5) cm long, (0.3) 0.5-3 (3.5) cm wide, entire or crenulate, densely white-tomentose on both surfaces, or often becoming less pubescent to subglabrous or nearly glabrous and green above, the petioles short to long, 2-15 mm long, subglabrous to tomentose, the petiole-bases 1.5-3 mm wide, subglabrous to tomentose externally, densely tomentose internally; stems tomentose or subglabrous to (rarely) glabrous, (8) 10-20 (25) cm long; bracts ternate, scalelike, 1-3 mm long, triangular, widening from acute apices to connate bases, tomentose or glabrous externally, tomentose internally, the bracts of the lower nodes of the inflorescences occasionally foliaceous and up to 2.5 cm long, similar to the leaves only more reduced; inflo-

rescences cymose with few to many tomentose or glabrous dichotomous or trichotomous branches, (1) 2.5-20 cm long; involucre sessile, turbinate, 1.5-3.5 mm long, 1-2 mm wide, tomentose to glabrous externally, glabrous internally, the 5 acute lobes from 1/6 to 1/3 the length of the tubes, the bractlets narrowly oblanceolate, 1-3.5 mm long, hirsutulous with long acute marginal cells, often with scattered capitate cells among the longer acute cells, the pedicels glabrous, 1.5-4 mm long; perianth white with greenish or reddish midribs, whitish-brown, pale yellow, or yellow, 2-3.5 (4) mm long, the calyx-segments \pm similar, the outer whorl of segments oblanceolate to spatulate with acute or rounded apices, the inner segments elliptical, slightly shorter and narrower than the outer segments, glabrous except for a few scattered hyaline hairs or minute glands on the midribs within; stamens mostly included, 1-4 (5) mm long, the filaments glabrous or more commonly pilose basally, the anthers 0.3-0.5 mm long, oblong; achenes brown, 2-2.5 (3) mm long, the ovoid to subglabrous bases tapering to retrorsely roughened or roughened 3-angled beaks.

KEY TO THE VARIETIES OF *ERIOGONUM CORYMBOSUM*

- A. Perianth white or brownish-white.
 - B. Leaves oblanceolate to elliptic, 1-3 (4.5) cm long, 1-2 cm wide, the petioles 2-6 mm long.
 - C. Involucres 1.5-2.5 mm long, 1-1.5 mm wide; stems spreading into subglobose crowns, the branches whitish-tomentose; perianth white; plants found mostly below 6000 feet, northwestern Colorado and adjacent southern Wyoming southward through northeastern and central Utah to north-central Arizona. 7a. var. *corymbosum*
 - CC. Involucres 2.5-3.5 mm long, 1.5-2 mm wide.
 - D. Stems and crowns open and erect, the branches brownish-tomentose; leaves 2-3.5 cm long, 0.5-1.5 cm wide, brownish-tomentose; plants found mostly above 6000 feet, northeastern Utah from western Wasatch Co. to extreme western Uintah Co. 7b. var. *erectum*
 - DD. Stems and crowns spreading, the branches silvery-tomentose; leaves 3-4 cm long, (0.5) 1-2 cm wide, silvery-tomentose; known only from Wellington, Carbon Co., Utah. 7c. var. *davidsei*

- BB. Leaves elliptical-oblong to ovate-orbicular, 1-3 (4) cm long, 1-3 (3.5) cm wide, the petioles 5-10 (15) mm long.
- C. Plants greenish; leaves densely tomentose below, subglabrous to glabrous and green above; perianth 2.5-3 mm long; plants found mainly on sandy soil, southeastern Utah and adjacent Colorado south into northeastern Arizona and extreme north-western New Mexico. 7e. var. *orbiculatum*
- CC. Plants brownish-white; leaves densely white-tomentose below, floccose and brownish- or yellowish-white above; perianth 2-2.5 mm long; plants found mainly on clay soils. west-central New Mexico. 7f. var. *velutinum*

AA. Perianth yellowish.

- B. Perianth pale yellow to yellow, 2.5-3 mm long; involucre 2.5-3 mm long; inflorescences less than 2 cm long; extreme eastern Utah Co. and adjacent Duchesne Co., Utah 7d. var. *albugilvum*
- BB. Perianth yellow, 1.5-2.5 mm long; involucre 1-2 mm long; inflorescences 3-10 cm long; southern Utah and northern Arizona. 7g. var. *glutinosum*

7a. *Eriogonum corymbosum* var. *corymbosum*

E. corymbosum var. *divaricatum* Torr. & Gray, Pacif. Railroad Report 2: 29. 1857. *E. divergens* Small, Bull. Torrey Bot. Club 33: 55. 1906, non *E. divaricatum* Hook. *E. effusum* Nutt. ssp. *divaricatum* S. Stokes, Gen. Eriog. 80. 1936. (TYPE: Near Green River, Emery Co., Utah, 1 Oct 1853, *Creuzfeldt on the Gunnison Expedition*. Holotype: NY! Isotype: GH!)

E. salinum A. Nels., Bull. Torrey Bot. Club 31: 240. 1904. *E. effusum* Nutt. ssp. *salinum* S. Stokes, Gen. Eriog. 81. 1936. (TYPE: Salt Well, Sweetwater Co., Wyoming, 17 Jul 1897, A. Nelson 3753. Holotype: RM! Isotypes: GH, US!)

E. effusum Nutt. ssp. *corymbosum* S. Stokes, Gen. Eriog. 79. 1936.

E. effusum Nutt. ssp. *durum* S. Stokes, Gen. Eriog. 80. 1936. (TYPE: Sunnyside, Carbon Co., Utah, 13 Sep 1901, M. E. Jones 11134. Holotype: POM! Isotype: NY!)

Shrubs or subshrubs, 3-8 dm high, the crowns suberect to subglobose, up to 1 m across; leaves lanceolate to oblanceolate or elliptic, 1-3 (4.5) cm long, (0.3) 0.5-1 (1.5) cm wide, the petioles short, 2-6 (8) mm long; bracts scalelike above, often becoming foliaceous below; inflorescences mostly cymose, trichotomous nearly throughout, 3-10 cm long, usually densely tomentose but becoming subglabrous

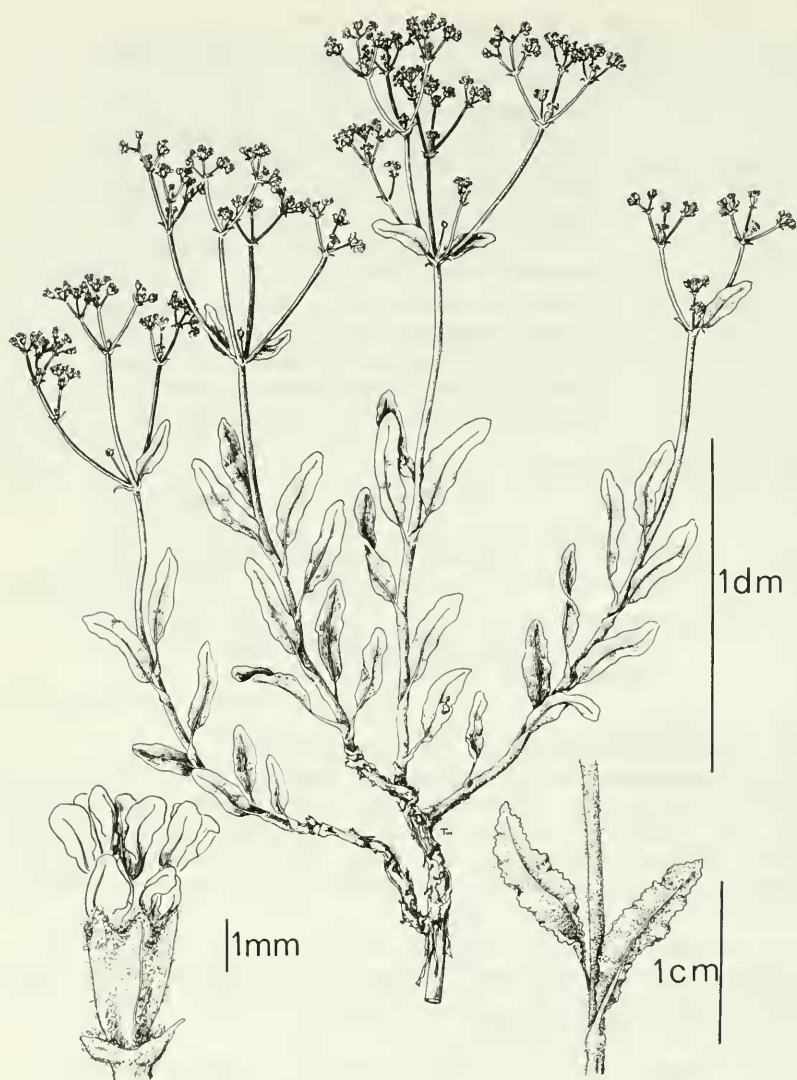


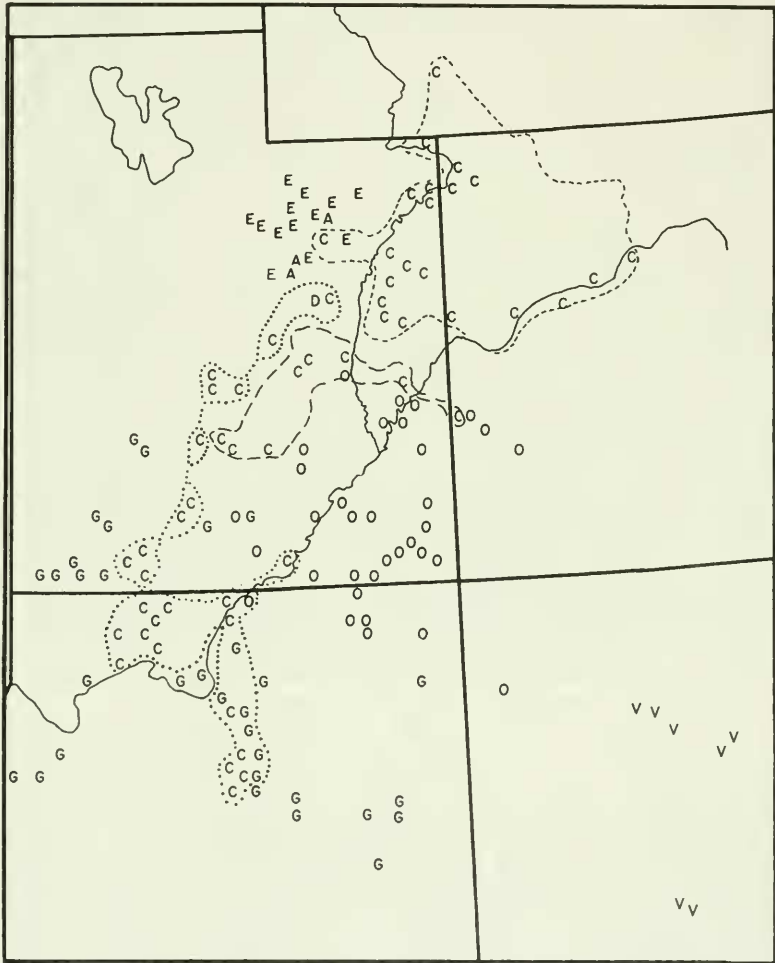
Fig. 7. Habit sketch of *Eriogonum corymbosum* var. *corymbosum* showing the general aspect of the species with enlarged drawings of the stem leaves and a single involucre with several exserted flowers.

in some; involucre 1.5-2.5 mm long, 1-1.5 mm wide; perianth white, 2-3 (3.5) mm long. Figure 7.

TYPE. COLORADO: Eagle Co. "On road—Day we reached Grand River." From the Frémont Report, the type area would be near Yarmony, NE of Piney Cr., near the Colorado River, 4 Sep 1845,

John C. Frémont 248. Holotype deposited at NY! Drawing, fragments, and photographs of this specimen are deposited at BRY. Iso-type: GH!

DISTRIBUTION. Northwestern Colorado and adjacent southwestern Wyoming south through northeastern and central Utah to north-central and northwestern Arizona. Map 3. Flowering mainly from late July to early October.



Map. 3. Distribution in Utah, Colorado, Arizona, and New Mexico of *Eriogonum corymbosum*, var. *corymbosum* (C) with short dash lines showing the form of the variety represented by the type, the long dash lines showing the desert form, and the dotted line which represents the low mountain and southern form; var. *erectum* (E); var. *davidsei* (D); var. *albogilvum* (A); var. *orbiculatum* (O); var. *velutinum* (V); and var. *glutinosum* (G).

REPRESENTATIVE SPECIMENS. ARIZONA: Coconino Co., Navajo Bridge, *Darrow* 2906 (ARIZ); Jumpup Spr., *Darrow* 2972 (ARIZ, CAS); 13 mi SE of Fredonia, *Eastwood & Howell* 6385 (CAS, US); 14 mi W of Cameron, *Kearney & Peebles* 12826 (GH, US), 12827 (ARIZ); 2 mi SE of Fredonia, *Reveal* 698 (ARIZ, BRY, CAS, DS, GH, KANS, MO, NY, OKL, RM, RSA, TEX, UC, US, UT, UTC, WIS); Moquitch Canyon, *Swapp* 44 (USFS); Wapatki N. M., *Whiting* 1089/5279 (ARIZ); Ryan, *Thackery* 569 (ARIZ, US). Mohave Co., Between Fredonia and Mt. Trumbull, *Mann* 2 (USFS); Boysag Point, *Michaels* 23 (ARIZ). COLORADO: Garfield Co., 20 mi SW of Rifle, *Waterfall* 11040 (OKL). Mesa Co., DeBeque, *Osterhout* 4753 (NY, RM), 5848 (OKL, RM); 0.2 mi E of the Utah-Colorado line along U. S. Hwy. 50-6, *Reveal & Davidse* 948 (BRY, NY, UTC). Moffat Co., Lodore Canyon, *Baker & Culler* 3489 (OKL); Dinosaur N. M., *Barmore s.n.* (UTC); Blue Mt., *McLeod* 51A (COLO). Montrose Co., Bedrock, *Payson & Payson* 3924 (GH, RM). UTAH: Without definite location. Southern Utah, *Siler* 141 (GH, ISC, MO, PH). Daggett Co., Hideout Camp, *Flowers et al.* 216 (UT). Duchesne Co., 2 mi S of Duchesne, *Reveal* 676 (BRY, NY, UTC). Emery Co., 0.5 mi N of San Rafael Bridge, *Harrison* 9807 (BRY, UC, UTC); San Rafael Swell, *M. E. Jones s.n.* (POM); 6 mi SE of Castle Dale, *McVaugh* 14593 (CAS, MICH, NY); Cottonwood Canyon, *Ware* 179 (USFS). Garfield Co., Bryce Canyon N. P., *Eastwood & Howell* 7170 (CAS, GH, UC, UTC); 15 mi N of Widtsoe, *Holmgren et al.* 2253 (BRY, CAS, DS, GH, ISC, MO, NY, OSC, RSA, TEX, UC, UTC). Grand Co., Turnbow Cabin, Arches N. M., *Welsh & Moore* 2709 (BRY). Kane Co., E of Zion N. P., *Eastwood & Howell* 6374 (CAS); Mt. Carmel, *Eastwood & Howell* 7127 (CAS); Mt. Carmel Junct., *Harrison* 11067 (BRY, UC, US, UTC); Glendale, *M. E. Jones* 6047b (MO, NY, UC); 2 mi above the Lake Canyon, *Lindsay* 103 (WIS); N of Kanab, *Milner* 8959 (US); ¼ mi S of Glendale, *Reveal & Holmgren* 316 (UTC, WTU). Sevier Co., Tony's Hollow, *Martineau* 119 (USFS); 1 mi up Red Cr., Salina Canyon, *Stevens* 90 (BRY, UTC). Uintah Co., Dinosaur N. M. Headquarters, *Bradley* 5371 (COLO); 33 mi S of Ouray, *Brotherston* 453 (BRY); 12 mi S of Ouray, *Brotherston* 519, 520 (BRY); Split Mt. Gorge, *Brotherston* 776 (BRY); Quarry, Dinosaur N. M., *Brotherston* 830 (BRY); 23 mi SE of Ouray, *Holmgren et al.* 2267 (BRY, CAS, DS, MO, NY, OSC, RM, TEX, UC, US, UT, UTC); 32 mi SE of Ouray, *Holmgren et al.* 2269 (BRY, CAS, DS, GH, MO, NY, OSC, RM, TEX, UC, US, UT, UTC); Tabyago Canyon, *Holmgren et al.* 2350 (BRY, CAS, DS, GH, MO, NY, RM, RSA, TEX, UC, US, UT, UTC, WIS); Upper Hill Cr., Tavaputs Plateau, *Vickery & Wiens* 1662 (DS, RSA, UC, UT, WTU); Overlook, Split Mt. Gorge, *Welsh* 379 (BRY). Wayne Co., Fruita, *Beck s.n.* (BRY); 7 mi E of Teasdale, *Harrison et al.* 7536 (BRY); Grover, *Holmgren, et al.* 2547 (BRY, NY, UTC); 5 mi E of Teasdale, *Holmgren et al.* 2550 (BRY, NY, UTC); Wayne Wonderland, *Milner* 7242 (UT); Rabbit Valley, *Ward* 561 (US).

The critical part of the discussion of *E. corymbosum* var. *corymbosum* is in regards to the type collection (fig. 8). First, the Frémont collection was made in 1845, and the label data given indicates that he obtained the specimens from near Yarmony, Eagle Co., Colorado. No other collection of this species is known at present to come from this area, and a recent visit to this area failed to reveal the plant. Thus, if the type came from this area, it is the easternmost collection. The interested reader of far western history of the United States will recall that following this collection, Frémont made an extended exploration trip through Utah, Nevada, and California, became involved in the Bear Flag Revolt and for his part in this affair was ordered out of the state into Oregon only to return later and become involved in the fight for California's independence from Mexico in the Mexican War. Needless to say, the type specimen of *E. corymbosum* went with him throughout his adventure, and suffered considerably. The specimens became partially destroyed, broken in places, and heavily infected with matted mycelium of a fungus. With such poorly preserved material, it was necessary for me to carry out de-



Fig. 8. Photograph of the holotype of *Eriogonum corymbosum*.

tailed morphological studies in order to correctly associate the subsequent specimens.

The holotype is deposited at the New York Botanical Garden and has few leaves, although the isotype at the Gray Herbarium has a few more. Thus, except for the leaf studies, all of the details have been taken from the holotype. The inflorescence of the holotype was manufactured when the specimen was mounted. The small pieces which bear the involucre were glued down to give a corymbose appearance rather than a cymose inflorescence as seen in the isotype, and in most of the subsequent collections. The pubescence of the stems, leaves, and involucre is obscured by the fungal mycelium. However, in a few small places, it is possible to see the kind of pubescence, and it too compares favorably with modern specimens.

When Torrey worked on the collection, he made a series of drawings on a small sheet of blue paper. Although the pencil drawings have faded over the years, they are still visible, and compare favorably with the present observations. Fortunately, the concept of *E. corymbosum* as held by most taxonomists is represented by the type, and through all of the difficulties experienced with the type collection, it has been possible to ascertain the identity of the holotype and conclude that the type represents that part of the overall species as outlined in this paper.

This conclusion was aided by several additional key specimens. The specimen at hand that comes closest to the holotype is another type collection. Aven Nelson collected the only specimens of *E. corymbosum* known from Wyoming² and described it as *E. salinum*. In making detailed comparisons with the Frémont collection, the Nelson specimens were found to be nearly identical. The several collections from the Dinosaur National Monument area also resemble the type closely, but these tend to have bracts which are somewhat longer and with the stem leaves closer together on the stem.

The plants from northwestern Colorado and adjacent northeastern Utah are generally of a shorter stature than those plants found elsewhere. The larger plants to the south which are generally in the foothills and the mountains were recognized by Stokes under the name *E. effusum* Nutt. ssp. *durum*, while the plants of intermediate stature which generally occur in the desert were described earlier as *E. corymbosum* var. *divaricatum* by Torrey and Gray.

In *E. corymbosum* var. *corymbosum* several different populations may be seen which are associated with corresponding variation in ecology and geology. As noted above, those plants which are similar to the holotype range from northwestern Colorado and adjacent Wyoming, westward into northeastern Utah, then south onto the Tavaputs Plateau (Map 3, p. 309). This southern line ends where this high plateau breaks off into the Roan and Book cliffs.

At the base of the Book Cliffs is the larger and more robust plant which Stokes named ssp. *durum*. The *durum* phase of var. *corymbosum* extends westward from the Book Cliffs over to the eastern front of the Wasatch Plateau, then southward along the mountains to its southern end where the species crosses the mountains and continues southward into southwestern Utah and adjacent Arizona (Map 3).

The desert form of *corymbosum* extends down the Green River drainage, and southward from the Book Cliffs onto the San Rafael Desert and the San Rafael Swells, with outlying populations in Arches National Monument and adjacent areas, and in extreme western Colorado. This plant was described as var. *divaricatum*. The *divaricatum* form of the variety is found on the clay soils, and

2. Recently (3 Aug 1967) Dr. C. L. Porter of the University of Wyoming recollected this variety in Wyoming in the same location as Nelson, 35 miles south of Rock Springs, Porter & Porter 10508 (BRY, RM). He found, intermixed with this species and *E. brevicaulis* (10509), a series of hybrids that would key out to the var. *albogilvum* (10510). However, unlike the Utah plants of var. *albogilvum*, the Wyoming plants seem to be only first generation hybrids.

extends as far south as this kind of soil is found or to where the sandy desert and *E. corymbosum* var. *orbiculatum* are encountered (Map 3).

Even though it is possible to discuss these various populations which have been given names, their distinction in the herbarium and in the field is not as great nor as consistent for recognition with as much certainty as those given formal taxonomic rank in this paper. In coming to this conclusion, no consistent separation was found possible when the geographical location was disregarded. Additional critical and detailed study may show that some of these forms can be distinguished, but if they are, other populations which are equally as distinct, will have to be recognized. At present, plants from Arches National Monument and the Capital Reef area are different, as are the plants in the foothills north of Bryce Canyon. Thus, as I see it, the var. *corymbosum* is a large and still variable taxon that is undergoing still more geographical isolation and speciation.

In southwestern Utah and particularly in northern Arizona, the var. *corymbosum* is similar to var. *glutinosum* in several features, and at times the two seem to differ only in flower color. Both occur in similar habitats, and often may be found growing in mixed populations. Considerable work (and probably genetic studies) is needed on this part of the species. As far as this paper is concerned, the two varieties will be basically separated on flower color, but realizing that in some populations, especially some of those in Arizona, the distinction may be artificial.

The relationships of *E. corymbosum* to the other species discussed in this paper show a reticulated pattern of development, and the linear arrangement of the species is therefore somewhat misleading. Probably the entity that comes closest to *E. corymbosum* is *E. hylophilum*; however, as noted in the discussions of the various species, this relationship is not clearly understood and highly speculative (fig. 9).

During recent field studies in western Colorado (1967), *E. sarothriforme* Gandg. (*Bull. Soc. Bot. Belg.* 42: 192. 1906) was seen and studied. Stokes (1936) reported that this species was referable to *E. corymbosum*, but in my opinion, *E. sarothriforme* is a member of the *E. brevicaulis* complex. The Colorado species has long, narrow, green basal leaves at the base of a green and glabrous branching inflorescence. It occurs mainly in Garfield Co., with a single floccose-tomentose collection (*Reveal & Davidse 860*) coming from Eagle Co.

The following varieties of *E. corymbosum* are all based on gross morphology, and the relationships expressed between them are mainly speculations.

7b. *Eriogonum corymbosum* var. *erectum* Reveal & Brotherson, var. nov.

A var. *corymboso* plantis fruticosis ad 6-10 dm altis, ubique brunneo-tomentosis, foliis lanceolatis vel ellipticis, 2-3.5 cm longis,

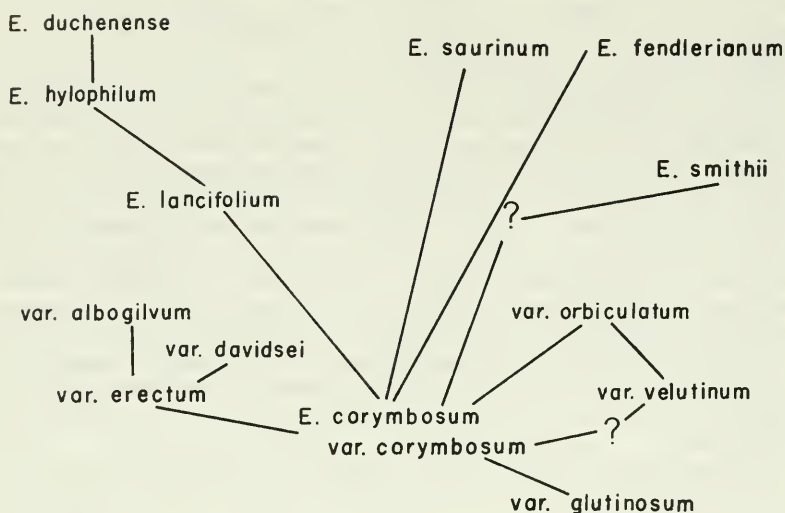


Fig. 9. Diagram showing the possible relationships between the various species and varieties in the *Eriogonum corymbosum* complex.

0.5-1.5 cm latis, inflorescentiis brevibus et compactis, densis, 2.5-7 cm longis, erectis, involucris 2.5-3.5 mm longis, 1.5-2 mm latis, perianthiis albo-brunneis, costa basi rosea, 2.5-3 mm longis differ.

Erect shrubs (3) 6-10 dm high, brownish-tomentose nearly throughout; leaves lanceolate to elliptic, 2-3.5 cm long, 0.5-1.5 cm wide, densely tomentose below, less so to subglabrous and green above, appressed to the stems and erect, the leaf-blades thick and stiff; inflorescences mostly short and compact, the branches dense, 2.5-7 cm long; involucre 2.5-3.5 mm long, 1.5-2 mm wide; perianth brownish-white with reddish midribs and bases, 2.5-3 mm long. Figure 10.

TYPE. UTAH: Wasatch Co. Along U. S. Hwy. 40, 5.5 mi E of Strawberry Reservoir, 33 mi W of Duchesne, sec. 28, T. 7 S., R. 10 W., elevation 7500 feet, 16 Aug 1966, Noel H. Holmgren & James L. Reveal 3022. Holotype deposited at UTC. Isotypes distributed to ARIZ, BRY, CAS, DS, GH, MO, NY, RM, RSA, UC, US, and other herbaria.

DISTRIBUTION. Widely scattered in northeastern Utah from Wasatch Co. to extreme western Uintah Co., Utah, mainly above 6000 feet elevation. Map 3. Flowering mainly from August to September.

REPRESENTATIVE SPECIMEN. UTAH: Duchesne Co., 10 mi up the Tabiona Road, Atwood 675 (BRY, UTC); 10 mi N of Altonah, Brotherson 604 (BRY); 5 mi N of Fruitland, Brotherson 477, 478 (BRY); 15 mi SW of Myton, Brotherson 720, 735 (BRY); Rock Cr., Brotherson 900 (BRY); Hanna, Christensen s.n. (BRY); 0.6 mi up Grass Hollow, Indian Creek Canyon, Holmgren & Reveal 3021 (BRY, NY, UTC); Pine Hollow, Hutchings s.n. (ARIZ); 16 mi N of Duchesne, Maguire 12523 (GH); 1 mi W of Mountain Home, Stoddart & Passey s.n. (OKL, UTC); 7 mi N of Duchesne, Stoddart & Passey s.n. (OKL, UTC). Summit Co., Uinta Mts., Milner 6766b (UT). Uintah Co., Dry Fork Mt., Andrews & Noble s.n. (DS, WS); 5 mi

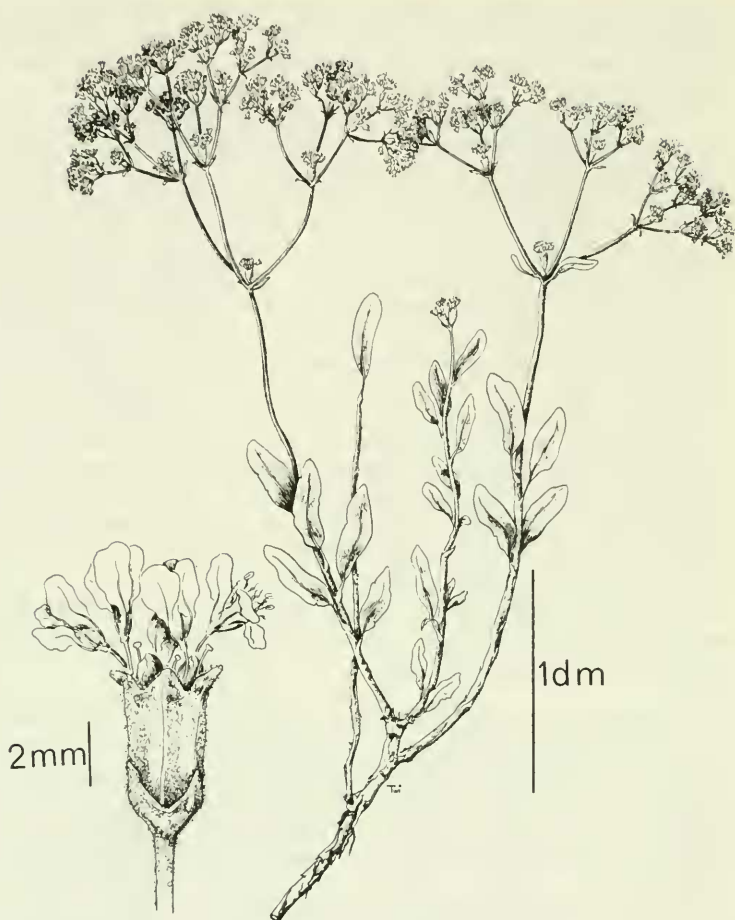


Fig. 10. Habit sketch of *Eriogonum corymbosum* var. *erectum* showing the erect stems and stem leaves with an enlarged drawing of a single involucre with several exerted flowers.

NW of Whiterock, *Brotherson* 551 (BRY); near Roosevelt, *Thorne* 18926 (RSA). Utah Co., 12 mi E of Soldier Summit, *Reveal & Reveal* 724 (BRY, NY, UTC); 12 mi E of Soldier Summit, *Welsh & Moore* 3426 (BRY). Wasatch Co., Strawberry Res., *Brotherson* 669 (BRY); Wolf Cr., *Garrett* 7487 (CAS, DS); between the head of Daniel's Canyon and Duchesne, *Garrett* 8037 (MO, UC, UT); 5 mi E of Strawberry Res., *Maguire* 17652 (GH, IDS, NY, OKL, UC, UTC), 17653 (NY, OKL, UC, UTC, WTU); 2 mi N of the summit of Indian Creek Canyon, *Maguire* 21324 (GH, UTC).

The discovery of this variety came as a result of detailed ecological studies by Jack D. Brotherson, presently a graduate student at Iowa State University, Ames, Iowa. Brotherson's master's thesis (1967), on the ecology of *E. corymbosum* in the Uinta Basin, dis-

closed that two distinct forms existed in this area. From herbarium studies, Brotherson and I could easily note var. *corymbosum* and var. *erectum* on the basis of the latter's more erect stems and decidedly brownish tomentose stems and branches.

In the field, the two taxa are quite distinctive. The var. *erectum* has a distinct brownish cast to its tomentum that is readily seen, and the crowns possess few and more erect stems. The leaves of var. *erectum* are generally not as spreading as in the var. *corymbosum*. Lastly, as Brotherson (1967) has shown, var. *erectum* occurs in scattered patches where it is often associated with *Artemisia* in Pinyon-Juniper Woodlands. This is unlike var. *corymbosum* of the lower portion of the Uinta Basin which is normally restricted to the clay hills and slopes where it is often associated with *Atriplex*. The distinct elevational differences between the two varieties are probably best seen in Indian Creek Canyon, southwest of Duchesne. The upper elevations have scattered plants of var. *erectum*; however, as one proceeds down the canyon, var. *erectum* is reduced in numbers and at middle elevations it is missing altogether. At the lower end of the canyon, long, rolling hills of a clay formation are found, and on these hills, var. *corymbosum* is fairly common. There is a gap of some five to eight miles between the two varieties, as well as nearly a thousand feet in elevation.

The relationship of var. *erectum* to var. *corymbosum* seems to be rather clear, with the var. *erectum* occupying a different ecological niche and geographical range.

7c. *Eriogonum corymbosum* var. *davidsei* Reveal, var. nov.

A var. *corymboso* et var. *erecto* plantis fruticosis 8-12 dm altis, ubique argenteo-tomentosis, foliis lanceolatis vel ellipticis, 3-4 cm longis, (0.5) 1-2 cm latis, inflorescentiis brevibus et compactis, densis, 3-6 cm longis, patulis, involucris 2.5-3 mm longis, 1.5-2 mm latis, perianthiis albo-brunnis, costa basi olivacea, 2-2.5 mm longis differt.

Large spreading shrubs 8-12 dm high and 5-15 (20) dm across, silvery-tomentose nearly throughout; leaves lanceolate to elliptic, 3-4 cm long, (0.5) 1-2 cm wide, densely tomentose below, less so but tomentose and whitish-green above, spreading from the stems, the leaf-blades thin and lax; inflorescences mostly short and compact, the branches dense, 3-6 cm long; involucre 2.5-3 mm long, 1.5-2 mm wide; perianth brownish-white with olive-green bases and thin, nearly indistinct, midribs, 2-2.5 mm long. Figure 11.

TYPE. UTAH: Carbon Co. 0.7 mi S of U. S. Hwy. 50-6 at Wellington just south of the Price River Bridge on the dirt road to Mound, on steep dark Mancos Shale hills, 9 Sep 1967, James L. Reveal & Gerrit Davidse 956. Holotype deposited at UTC. Isotypes distributed to ARIZ, BRY, CAS, DS, GH, MO, NY, RM, RSA, UC, US, and other herbaria.

DISTRIBUTION. Known only from the low Mancos Shale hills on the river bank along the Price River south of Wellington, Carbon Co., Utah. Map 3. Flowering from August to October.

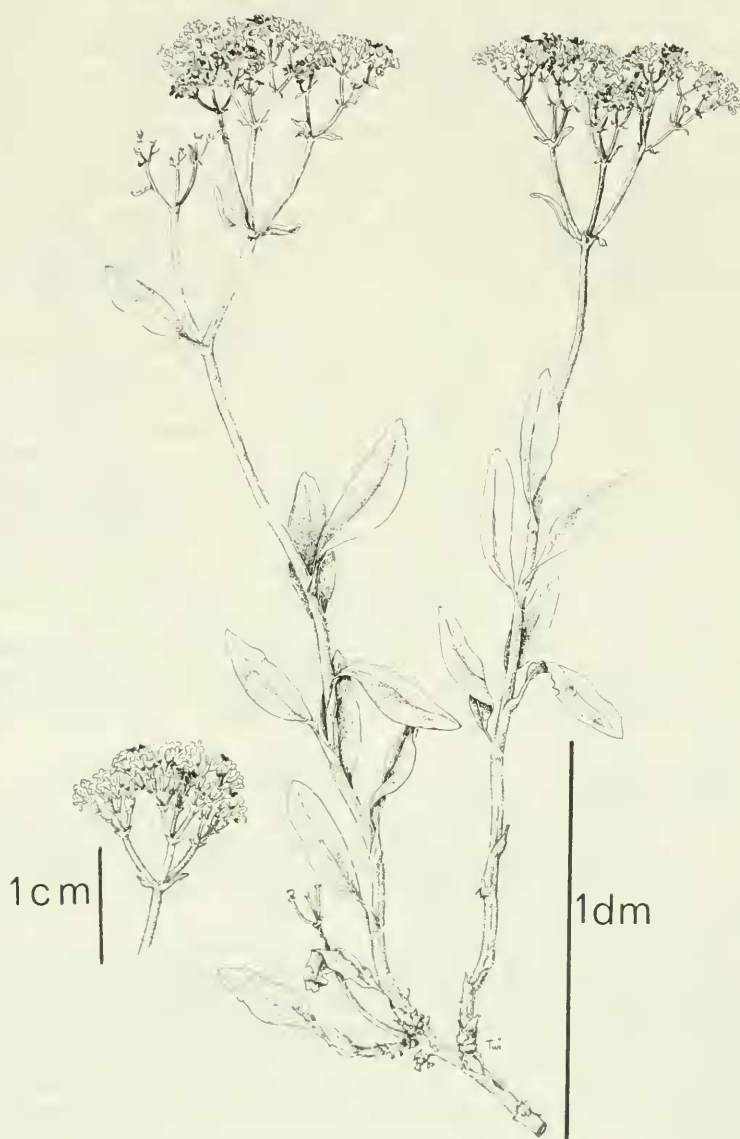


Fig. 11. Habit sketch of *Eriogonum corymbosum* var. *davidsei* showing the general aspect of the species with an enlarged drawing of a single involucre with several exserted flowers.

SPECIMENS EXAMINED. Known only from the type although additional living material was obtained on 12 Oct. 1967 for illustrations and further study.

The var. *davidsei* seems to be closely related to var. *erectum* from which it differs only in a few technical characteristics. Nevertheless, var. *davidsei* is distinct in its ecological and edaphic requirements. As noted above, the var. *erectum* commonly occurs in the mountains on sandy soils associated with *Artemisia* in pinyon-juniper. The var. *davidsei*, on the other hand, is found on low rolling Mancos Shale hills south of Wellington, Utah, where it is associated with *Atriplex*. The type area of the new variety is along the banks of the Price River and the plants are exceedingly large and robust, most unlike the narrowly erect, few branched forms of var. *erectum*. The leaf width and length of var. *davidsei* is the greatest in this part of *E. corymbosum*, but it does not approach the leaf length-width ratio of either var. *orbiculatum* or var. *velutinum*.

The most striking morphological feature observed in the field is the silvery tomentum which is exceedingly soft and felt-like. This gives the plants a distinct cast against the otherwise dark clay slopes and allows them to be easily seen from a distance. The crowns which tend to be densely branched with numerous short flowering inflorescences also give the plants a distinct appearance as the resulting round-shaped crowns are a mass of flowers, although the crowns are not as dense as in var. *orbiculatum*. When this plant was collected in September, it was necessary to scare away numerous honeybees which were probably from local hives in the Wellington area. Some small flies were also seen on the flowers.

This variety is named for Mr. Gerrit Davidse, a graduate student in botany from Utah State University, Logan, who collected with me on an extended trip into Texas and adjacent states in August and September, 1967.

7d. *Eriogonum corymbosum* var. *albogilvum* Reveal, var. nov.

A var. *erecto* plantis subfruticosis, (1.5) 2-4 dm altis, foliis ellipticis, 1-2 (2.5) cm longis, 4-7 mm latis, supra virido-tomentosis, subra subglabris et viridis, inflorescentiis brevibus et compactis, 1-3 cm longis, involucris 2.5-3 mm longis, 1.5-2 mm latis, perianthiis albo-gilvum vel gilvum differt.

Erect subshrubs, (1.5) 2-4 dm high, whitish to brownish tomentose nearly throughout; leaves elliptical, the leaf-blades 1-2 (2.5) cm long, 4-7 mm wide, densely greenish-white tomentose below, subglabrous and green above, appressed to the stems and erect, the petioles 1-3 mm long; inflorescences short and compact, 1-3 cm long; involucre 2.5-3 mm long, 1.5-2 mm wide; perianth pale yellow to yellow with reddish-brown midribs and bases, 2.5-3 mm long. Figure 12.

TYPE. UTAH: Duchesne Co. About 3 mi N of the Indian Creek Canyon Summit along Utah Hwy. 33, on steep hillside, sec. 1, T. 10 S., R. 8 W., elevation 8500 feet, 26 Aug 1966, *James L. Reveal & Caroline G. Reveal* 726. Holotype deposited at UTC. Isotypes will

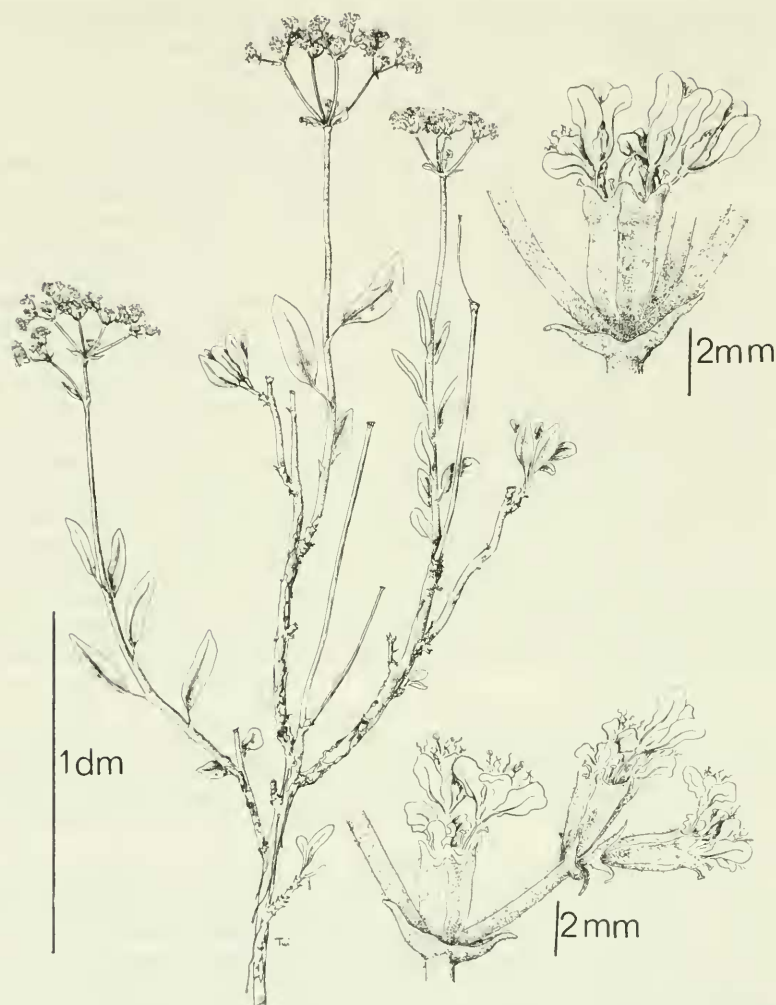


Fig. 12. Habit sketch of *Eriogonum corymbosum* var. *albogilvum* showing the erect stems and short compact inflorescences with two enlarged sketches of the basal node of the inflorescence which shows three involucres and several exserted flowers subtended by bracts, and a single enlarged involucre with several exserted flowers.

be distributed to ARIZ., BRY., CAS., DS., GH., MO., NY., RM., RSA., UC., US., and other herbaria.

DISTRIBUTION. Infrequent and widely scattered in the upper end of Indian Creek Canyon, east of Soldier Summit at the head of Price Canyon, and north of Duchesne, in Duchesne and Utah counties, Utah. Map 3. Flowering mainly in August and September.

SPECIMENS EXAMINED. UTAH: Duchesne Co., 8 mi N of Duchesne along Utah Hwy. 87, *Welsh & Moore 6775* (BRY). Utah Co., 12 mi E of Soldier Summit, *Reveal & Reveal 725* (BRY, NY, UTC); 12 mi E of Soldier Summit, *Welsh & Moore 3425* (BRY).

It is suggested that *E. corymbosum* var. *albogilvum* is of a hybrid origin between *E. corymbosum* var. *erectum* and *E. brevicaule* Nutt. var. *laxifolium* (Torr. & Gray) Reveal³ or var. *pumilum* S. Stokes ex M. E. Jones. Evidence for this statement is based on field observations and on pollen analysis. In the field, var. *albogilvum* is always associated with the two suggested parents, and is intermediate in several respects to them. The var. *albogilvum* is similar to var. *erectum* in its overall morphology, and is not at all similar to *E. brevicaule* var. *laxifolium* which is low and nearly caespitose with its tomentose stems less than 10 cm long and topped by a capitate inflorescence. Nor is the var. *albogilvum* similar to var. *pumilum* which has an umbellate inflorescence and otherwise similar to var. *laxifolium*. The flowers of var. *erectum* are brownish-white, while those of var. *laxifolium* and var. *pumilum* are yellow. The flowers of var. *albogilvum* are mostly pale yellow, although the plants from north of Duchesne (*Welsh & Moore 6775*) vary from pale yellow to bright yellow, and thus of an intermediate condition. The stem and branch pubescence is similar to var. *erectum*, but the leaf pubescence which is greenish and nearly glabrous above, is similar to var. *laxifolium* and var. *pumilum*. The leaf shape, however, is similar to var. *erectum* and not at all similar to the leaves found in the two varieties of *E. brevicaule*.

From the pollen analysis of the type collection, it has been found that the var. *albogilvum* has from 80 to 90 percent of its pollen viable, and this seems to show some hybridization has occurred but that its effect has been lessened, possibly by backcrossing. Both of the supposed parents were found to have about 100 percent pollen fertility.

In Indian Creek Canyon and north of Duchesne where the populations are rather extensive, the var. *albogilvum* appears to have become stabilized, and apparently is not backcrossing with var. *erectum*. However, at the site east of Soldier Summit, the var. *albogilvum* appears to be in danger of becoming swamped by var. *erectum*, and this population is not nearly as stable as the other known populations.

3. The large and complex species, *Eriogonum brevicaule*, is in a current state of reevaluation, especially in Utah where several distinct forms are found. Although considerable adjustment must be made in the rest of the species in Utah, this combination is made so that it can be used in this paper and in the *Eriogonum* treatment for the Pacific Northwest Flora. The var. *laxifolium* ranges from 5000 feet to more than 10,500 feet elevation, and may be distinguished from the other varieties in *E. brevicaule* by its capitate inflorescences. Along the middle elevations of the Wasatch Front, the var. *laxifolium* is largely replaced by the var. *pumilum* S. Stokes ex M. E. Jones. The combination may be made as follows:

The following are synonyms:

Eriogonum brevicaule Nutt. var. *Laxifolium* (Torr. & Gray) Reveal, comb. nov.
E. kingii Torr. & Gray var. *laxifolium* Torr. & Gray, Proc. Amer. Acad. 8:165. 1870.
E. chrysocephalum A. Gray, Proc. Amer. Acad. 11:101. 1876, a substitute name for var. *laxifolium*.
E. ochrocephalum S. Wats. var. *angustum* M. E. Jones, Contr. West. Bot. 11:9. 1903. *E. medium* Rydb., Flora Rocky Mts. 220. 1917. *E. nudicaule* (Torr.) Small ssp. *angustum* S. Stokes, Gen. Eriog. 84. 1936. *E. chrysocephalum* A. Gray ssp. *bannockense* S. Stokes, Leaflet West. Bot. 3:200. 1941. *E. bannockense* attrib. to S. Stokes by R. J. Davis, Flora Idaho 246. 1952.

The var. *albogilvum* presents several difficult problems in regards to nomenclature. The fact that hybrids exist is no longer questioned, and even now the International Code (1966) provides for their nomenclatural recognition. The problem with var. *albogilvum* is that it is of a hybrid origin between two different species, and back-crossed onto one of the parents, and while in this immediate point of time it seems to be stable, it may not continue to exist as a discrete and self-reproducing population.

Several approaches to this problem can be taken. First, the plants can simply be ignored, or mentioned in the discussion as an occasionally found population. Secondly, the plants can be given a species hybrid name, but as I understand the Code, this is usually restricted to sterile F_1 hybrids, and I think such a concept should continue. This population may be recognized, taxonomically, as a mere form, but again, for those who prefer the use of *forma*, of which I am not one, these are usually single individuals which differ from the rest of the population in some (often mutable) single characteristic. Actually, the var. *albogilvum* does not really fit into any of these categories. Variation within species are often introduced from outside species through hybridization. Yet there is no reason to assume that the same thing cannot happen within a definable part of the species, or as in our case, within a variety of the species. Normally such occurrences are unsuccessful, or happened so long ago that the incoming characteristics have been incorporated within the population and only by experimental evidence is it possible to discover this outside influence.

7e. *Eriogonum corymbosum* var. *orbiculatum* (S. Stokes) Reveal & Brotherson, stat. & comb. nov.

E. effusum Nutt. ssp. *orbiculatum* S. Stokes, Gen. Eriog. 79. 1936.

E. divergens sensu authors. non *E. corymbosum* var. *divaricatum* Torr. & Gray.

E. jonesii sensu authors, non *E. jonesii* S. Wats.

E. nummulare sensu authors, non *E. nummulare* M. E. Jones.

Large subshrubs or shrubs, 3-12 dm high, forming compact, hemispherical crowns of numerous divaricated branches, the shrubs often bright green; leaves elliptical-oblong to ovate-orbicular, 1-3 (4) cm long, 1-3 (3.5) cm wide, floccose to tomentose on both surfaces, often somewhat less dense above than below, the petioles 5-10 (15) mm long; inflorescences of dense, compact, short branches, often up to 20 cm long, rigid; perianth white with green or reddish midribs and bases, 2.5-3 mm long. Figure 13.

TYPE. UTAH: Emery Co. Green River, 3 Nov 1915, *M. E. Jones s.n.* Holotype deposited at POM! Isotypes: ns, POM!

DISTRIBUTION. Eastern Utah south of the Book and Roan cliffs and adjacent western Colorado south along the Green and Colorado

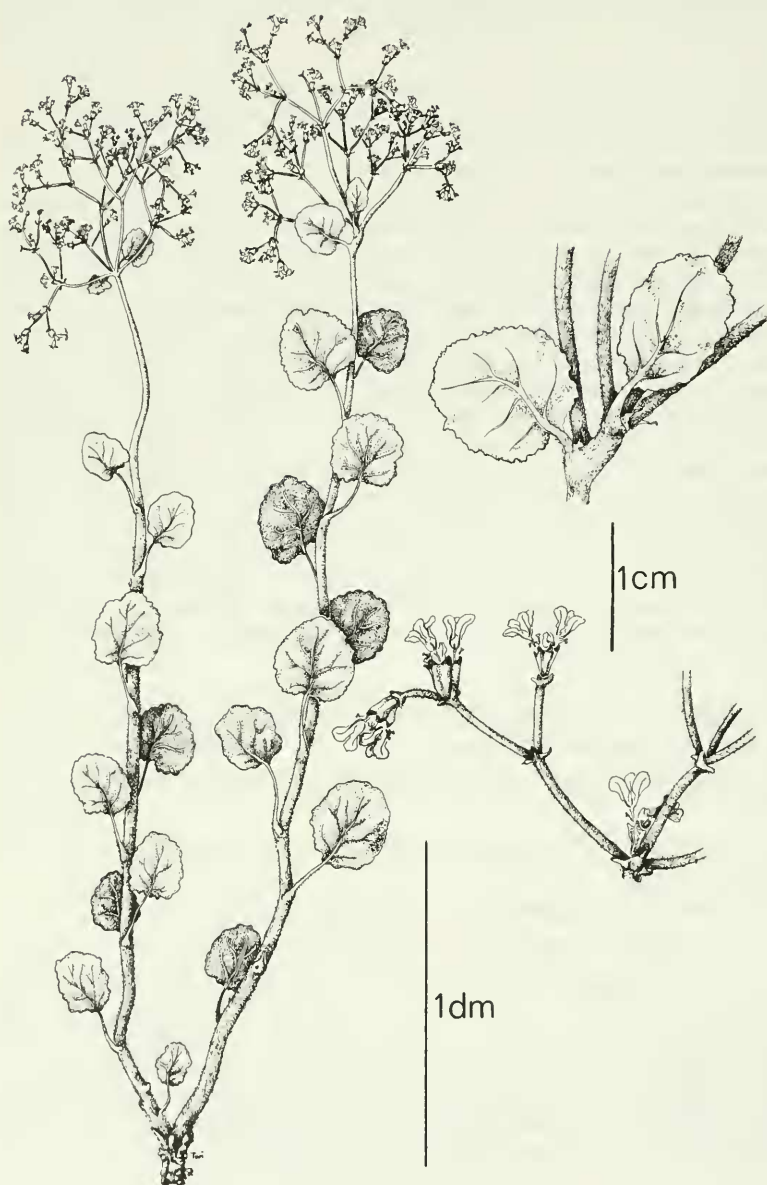


Fig. 13. Habit sketch of *Eriogonum corymbosum* var. *orbiculatum* showing the narrowly erect stems and compact inflorescences with enlarged drawings of part of an inflorescence with several involucres and exserted flowers and of the basal node of the inflorescence with large leaves at this node.

river drainages into northeastern Arizona and adjacent northwestern New Mexico. Map 3. Flowering from late July to early November.

REPRESENTATIVE SPECIMENS. ARIZONA: Apache Co., Between Many Farms and Round Rock, *Barr et al 1991a* (ARIZ, UT). Coconino Co., 2 mi below Navajo Bridge, *Cutler 3189* (GH, NY OKL); Bass Canyon, Grand Canyon, *Thornber 2821G* (ARIZ). Navajo Co., 3 mi N of the Totem Poles, *Blass 33* (UC); 8 mi E of Kayenta, *Cutler 2876* (DS, NY); Kayenta, *Eastwood & Howell 6547* (CAS, DS, GH, NY, POM, UC, US); 28 mi SE of Kayenta, *Hutchinson 7432* (COLO); Monument Valley, *Peebles & Fulton 11947* (ARIZ). COLORADO: Montrose Co., 1 mi above Uravan, *Ownbey 1506* (DS, GH, IDS, MO, MONTU, NY, ORE, RM, UC, USFS, UTC, WS, WTU); 31 mi SE of Gateway, *Weber 3564* (ARIZ, BM, CAS, COLO, DS, MONTU, OKL, PH, RM, RSA, TEX, UC, UTC, WS, WTU). San Miguel Co., Basin Cr., *Ownbey 1499* (CAS, DS, IDS, NY, OKL, POM, UC, US, UTC, WS, WTU). NEW MEXICO: Without definite location, Mesa la Vaca, *Marsh 244* (US); Bad Lands, *Wootton 2815* (ARIZ, US). McKinley Co., Chaco Canyon, *Clark s.n.* (NMU). UTAH: Garfield Co., 17 mi S of Escalante, *Beck s.n.* (BRY); 50 mi S of Escalante, *Beck s.n.* (UTC); Tickaboo Canyon, Colorado River, *Lindsay 21* (UC, WIS); Mt. Ellen, *Osgood s.n.* (US). Grand Co., Moab, *M. E. Jones in 1891* (MO, US). in 1913 (POM); 6 mi N of Moab, *Maguire & Maguire 5852* (UTC); 6 mi W of Moab, *Maguire & Richards 13301* (GH, NY, OKL, UTC); near Castleton Cr., *Moran 1419* (DS); 8 mi NW of Moab, *Waterfall 11407* (OKL, UTC); Courthouse Towers, Arches N. M., *Reveal 686* (ARIZ, BRY, CAS, DS, GH, KANS, MO, NY, OKL, OSC, RM, RSA, TEX, UC, US, UT, UTC, WIS). San Juan Co., Bridge Canyon, Natural Bridges, N. M., *Clover 4039* (ARIZ); 8 mi NW of Oljeto Post, *Cutler 2251* (CAS, GH, MO, US); 1 mi NW of Wide Butte, *Cutler 2989* (DS, GH, NY, OKL), 2999 (DS, GH, NY, OKL, WIS); Cooper Canyon, *Cutler 3169* (DS, NY, OKL); Barton Range, *Eastwood 129* (GH, MO, UC, US); Cottonwood Wash, *Ferris 11638* (DS); Rainbow Bridge Trail, *Goodman & Payson 3261* (UC, WTU); 3 mi N of Red Mesa, *Harrison 12189* (BRY); Monument Valley, *Holmgren 3850* (GH, NY, UC, UTC, WIS, WS); Monument Pass, Monument Valley, *Holmgren & Reveal 2999* (BRY, NY, UTC); 8 mi S of Bluff, *Maguire et al. 5851* (GH, UC, UTC); 15 mi S of LaSal Junct., *Reveal 687* (ARIZ, BRY, CAS, DS, GH, KANS, MO, NY, OKL, OSC, RM, RSA, TEX, UC, US, UT, UTC, WIS); 1.2 mi E of Utah highway 47 on Utah highway 262, *Reveal 689* (ARIZ, BRY, CAS, DS, GH, KANS, MO, NY, OKL, OSC, RM, RSA, TEX, UC, US, UT, UTC, WIS); near The Tanks, *Rydberg & Garrett 9875* (GH, MO, NY, US, WIS); 3 mi S of Kane Spr., *Welsh & Moore 1846* (BRY, ISC, WIS); Elephant Hill, *Welsh et al. 3707* (BRY); 1 mi E of Upheaval Dome, *Welsh & Moore 3854* (BRY). Wayne Co., Marvine Laccolite, *M. E. Jones 5663* (MO, NY, POM, UC, US).

Eriogonum corymbosum var. *orbiculatum* has been known to taxonomists under a variety of names for several years. In 1906, Small proposed a new name for *E. corymbosum* var. *divaricatum*, but when he applied the name, *E. divergens*, to plant specimens, they represented the var. *orbiculatum* instead of the kind of plant typified by the Gunnison expedition type. Rydberg, in his flora on the Rocky Mountains (1917), applied the name *E. jonesii* S. Wats. to this population, and this error has resulted in the reports of this species being found in Utah. Actually, *E. jonesii* is a narrow endemic species known only from northwestern Arizona (Reveal, in press c). While *E. jonesii* does approach var. *orbiculatum* in its wide leaves, *E. jonesii* has leaves that are cordate and nearly always basal, and not at all like var. *orbiculatum*.

In her monograph, Stokes (1936) discusses at some length the variation in the taxon, and yet, for some reason, she selected as the type a Jones specimen that is on the very edge of the variation within what is here defined as var. *orbiculatum*. Certainly the leaves are rotund, but they are exceedingly small, and the plants in the type

area tend to be somewhat less hemispheric in shape than those found further to the south.

The hemispheric crowns in this variety are rather interesting to observe in the field. The new year's growth begins on the stems of the previous year and grows slowly throughout the spring and early summer. As the season moves into July, the branches divide into the inflorescences which are so profuse as to make the top of the crown exceedingly firm and rigid. In late August the crowns which are bright green start to flower. The green branches of the inflorescences are gradually masked by the white flowers so that in September massive rounded humps are seen spotting the red sands in southeastern Utah.

7f. *Eriogonum corymbosum* var. *velutinum* Reveal, var. nov.

A var. *orbiculato* plantis fruticosis ad 5-10 dm altis, ubique albotomentosis, foliis ellipticis vel oblongis, (1.5) 2-2.5 cm longis, (1) 1.5-2.5 cm latis, inflorescentiis compactis, densis, 4-9 cm longis, perianthiis brunneo-albis, 2-2.5 mm longis differt.

Large, densely grayish-white tomentose shrubs 5-10 dm high, the tomentum matted and velvet-like, the plants forming rather compact crowns of several branches; leaves elliptical to oblong, mostly truncate at the bases, (1.5) 2-2.5 cm long, (1) 1.5-2.5 cm wide, densely white-tomentose below, less so and brownish-floccose above, the petioles 0.5-1.5 cm long; inflorescences of dense, compact, short branches, 4-9 cm long, densely tomentose; perianth brownish-white with light brown midribs and bases, 2-2.5 mm long. Figure 14.

TYPE. NEW MEXICO: Socorro Co. 7.6 mi E of the junction of Interstate 25 and U. S. Hwy. 380 near San Antonio, at the base of a small ridge system in dark, heavy soil, 5 Sep 1967, *James L. Reveal & Gerrit Davidse* 919. Holotype deposited at UTC. Isotypes distributed to ARIZ, BRY, CAS, DS, GH, MO, NY, RM, RSA, UC, US, and other herbaria.

DISTRIBUTION. West-central New Mexico from Sandoval and Santa Fe cos. south to Socorro Co. on heavy clay, gypsum, or occasionally sandy soils. Map 3. Flowering mainly in August and September.

SPECIMENS EXAMINED. NEW MEXICO: Sandoval Co., San Ysidro, *Arsene* 19424 (P); San Ysidro, *Barneby* 12828 (CAS, NY); San Ysidro *Benedict* 2255 2268, 2302 (US); LaVantaua Coal Mine, *Casteller* 3756 (NMU); 6 mi NW of San Ysidro, *Reveal & Davidse* 925 (BRY, NY, UTC); 4 mi S of San Luis, *Springfield* 429 (US, USFS); 4 mi N of San Luis, *Springfield* 733 (NMU). Santa Fe Co., 3 mi NE of Los Cerrillos, *Bennett* 8222 (TEX); Los Cerrillos, *Herrick* 778 (US); 1.8 mi N of Los Cerrillos, *Reveal & Davidse* 922 (BRY, NY, UTC). Socorro Co., 7 mi E. of San Antonio. *Barneby* 12895 (CAS, NY); 3 mi E of San Antonio, *Dunn & Lint* 4630 (NMU).

The var. *velutinum* is the large and distinctive form of the species found in west-central New Mexico and thus largely isolated from the rest of the species. Like var. *orbiculatum*, the var. *velutinum* is rather uniform throughout its range even though it occurs

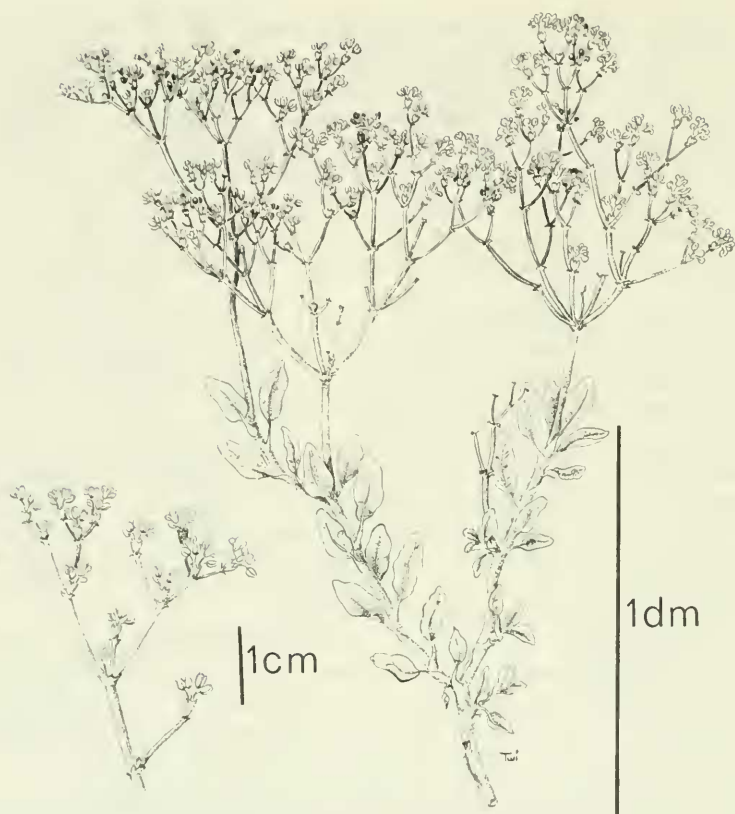


Fig. 14. Habit sketch of *Eriogonum corymbosum* var. *velutinum* showing the general aspect of the plant with an enlarged drawing of part of the inflorescence.

on a wide variety of edaphic conditions. For the most part, the var. *velutinum* is on clay slopes on the low foothills of the mountains, although near Los Cerrillos it is fairly common on sandstone outcrops and northwest of San Ysidro it is usually on gypsum slopes. The plants tend to be most robust on the clay soils and the least robust on the gypsum soils.

In the field, this variety is distinguished by its whitish-brown or whitish-green color of the densely matted tomentose stems and branches and the brownish-white color of the flowers. The plants have rounded crowns, but these are not nearly as dense as the var. *orbiculatum*. This is due to the fact that the branches of var. *velutinum* tend to be more erect and do not normally lay on the ground. The leaves which are spreading, are not as round as var. *orbiculatum*, but tend to be slightly longer than broad. While the tomentum of var. *velutinum* is matted and dense, it is not nearly as soft as var. *davidsei*.

7g. *Eriogonum corymbosum* var. *glutinatum* (M. E. Jones) M. E. Jones, Contr. West. Bot. 11: 14. 1903.

E. aureum M. E. Jones, Proc. Calif. Acad. II, 5: 719. 1895. *E. fruticosum* A. Nels., Bot. Gaz. 34: 23. 1902, a superfluous substitute. *E. microthecum* Nutt. ssp. *aureum* S. Stokes, Gen. Eriog. 76. 1936. (TYPE: St. George, Washington Co., Utah, 28 Sep 1894, M. E. Jones 6091. Holotype: POM! Isotypes: MO, NY, UC, US!)

E. aureum var. *glutinatum* M. E. Jones, Proc. Calif. Acad. II, 5: 720. 1895. *E. fruticosum* var. *glutinatum* A. Nels., Bot. Gaz. 34: 23. 1902.

E. crispum L. O. Will., Bull. Torrey Bot. Club 59: 427. 1932. *E. microthecum* Nutt. var. *crispum* S. Stokes, Gen. Eriog. 76. 1936. (TYPE: Cedar Canyon, east of Beaver, Beaver Co., Utah, 2 Sep 1931, A. O. Garrett 6027. Holotype: RM! Isotype: UT!)

Subshrubs or shrubs 2-8 (10) dm high, forming large open to compact, hemispheric crowns with few to many divaricated branches; leaves lanceolate to oblanceolate or elliptic, 1-4 cm long, 0.5-1.5 cm wide, the petioles 5-10 mm long; inflorescences cymose, the branches short, glabrous to tomentose, 3-10 cm long; involucre 1-2 mm long, 1-1.5 (2) mm wide; perianth yellow, 1.5-2.5 mm long. Figure 15.

TYPE. ARIZONA: Navajo Co. Holbrook, 22 Aug 1883, *Rusby* 808. Holotype deposited at US! Isotypes: MICH, MO, NY, ORE, UC, US!

DISTRIBUTION. Southwestern and south-central Utah southward to north-central Arizona where it occurs mainly on sandy soils. Map 3. Flowering mainly from late July to early October.

REPRESENTATIVE SPECIMENS. ARIZONA: Apache Co., Petrified Forest N. M., *Borell* s.n. (UC); Chinle, *Demaree* 38524 (OKL); Crazy Cr., *Eastwood & Howell* 6898 (CAS, US); Adamana, *Rusby* s.n. (NY). Coconino Co., Lee Canyon, *Clover* 7241 (MICH); Houserock Valley, *Eastwood & Howell* 6482, 6483 (CAS); Meteor Crater *Eastwood & Howell* 6915 (CAS, US); Sunset Crater, *Gaines* 1310, 311, 1312 (ws); Cape Royal, Grand Canyon, *Goodman* 6184 (OKL); 20 mi NW of Winslow, *Hall* 11178 (UC); Cameron, *Hanson* A190 (COLO, MO, NY, OSC); Wupatki N. M., *D. J. Jones* 157 (ARIZ, NY), 54-1939 (ARIZ, CAS); Billings, *M. E. Jones* 4708 (ARIZ, BM, CAS, COLO, GH, NY, POM, US, UTC); 14 mi W of Cameron, *Kearney & Peebles* 12823 (ARIZ, NY, US), 12824, 12825 (ARIZ, US); San Francisco Mts., *Knowlton* 217 (GH, US), 249 (US); Sunset Mt., *Purpus* 32, 33 (MO, UC, US); Point Sublime, Grand Canyon N. P., *Reveal* 695 (ARIZ, BRY, CAS, DS, GH, KANS, MO, NY, OSC, RM, RSA, TEX, UC, US, UT, UTC, WIS); 4 mi N of Cosnino, *Wetherill* s.n. (ARIZ); near Flagstaff, *Whiting* 916/3214 (ARIZ, NY). Mohave Co., W of Peach Spr., *Barneby* 5005 (CAS, NY); Toroweap, *Cottam* 13950 (ARIZ, CAS, UT); 3 mi E of Chloride, *Darrow & Gould* 3756 (ARIZ). Navajo Co., Mishongnovi, *Cutler* 3101 (DS, NY, OKL); Little Colorado River, *Hough* 90 (US); Hopi Indian Res., *Whiting* 854/2831 (ARIZ); Holbrook, *Zuck* s.n. (US). UTAH: Beaver Co., 2 mi N of Beaver, *Maguire* 17538 (GH, OKL, UC, UTC, WTU), 17539 (OKL, UTC). Garfield Co., 8 mi NE of Henrieville, *Cottam* 14112 (POM, UT); 20 mi SW of Escalante, *Holmgren et al.* 2413 (BRY, CAS, GH, MO, NY, OSC, RM, RSA, TEX, UC, US, UT, UTC); near Widtsoe, *Smith* s.n. (UTC). Iron Co., 8.7 mi SE of Cedar City, *Dress* 4758 (BM); 10 mi E of Cedar City, *Hitchcock et al.* 4621 (CAS, DS, ISC, MONTU, NY, OKL, POM, RSA, UC, US, UTC, WS, WTU); 5 mi E of Cedar City, *Maguire & Richards* 13292 (GH, UC, UTC). Washington Co., Zion N. P., *Bacigalupi* 2799 (CAS, DS, RSA); Gunlock, *Cottam* 5358 (BRY, UT); Beaver Dam Mts., *East-*

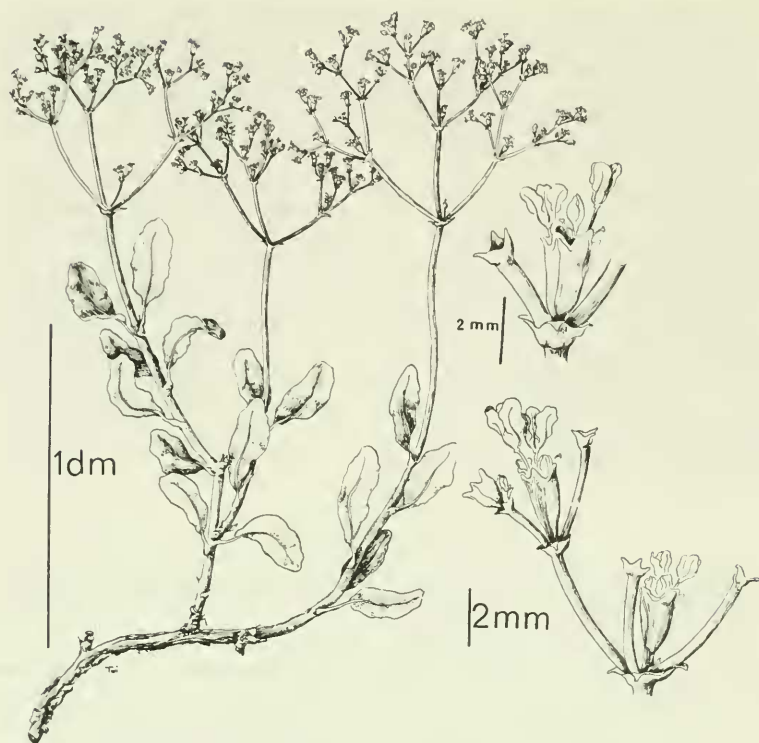


Fig. 15. Habit sketch of *Eriogonum corymbosum* var. *glutinosum* showing the general aspect of the plant with enlarged drawings of the inflorescence and an involucre with exserted flowers.

wood & Howell 6318 (CAS, DS, UC); Jackson Road, Higgins 810 (BRY); 1 mi N of Hurricane, Maguire & Blood 4374 (GH, UC, UTC); St. George, Palmer 6787 (BM, MO, NY); 5 mi W of Santa Clara, Reveal & Reveal 586 (CAS, MO, UTC).

The distinction of *E. corymbosum* var. *corymbosum* and var. *glutinosum* has been discussed previously under var. *corymbosum*, and the only point that needs to be noted here is that the area of overlap between the two forms is small, and thus the distinction presented here is valid. While some mixed populations (such as that west of Cameron, Coconino Co., Arizona) seem to be separated only on flower color, the vast majority of specimens present no problems. As the var. *glutinosum* occupies a distinct geographical area and can be separated by morphological characteristics, it is recognized at the varietal level.

When Jones (1895) described *E. aureum*, he recognized two varieties. Two of the taxa proposed, *E. aureum* and the var. *glutinosum*, are the same kind of plant, and when he recognized this in 1903, Jones reduced the species to a variety of *E. corymbosum*. The third taxon, var. *ambiguum*, however, is the yellow-flowered form

of *E. microthecum* from the southern Sierra Nevada, and this has only been recently noted by Reveal (In Munz, in press). Stokes must have based the concept of her "ssp. *aureum*" to a large degree on the Sierra Nevada material as she placed this taxon under *E. microthecum* rather than under *E. effusum* Nutt. where the remainder of the *E. corymbosum* complex had been placed.

Jones distinguished the var. *aureum* from the var. *glutinosum* on the basis that the first had glabrous stems while the second had tomentose stems. This distinction does not seem to be of much importance here, a conclusion that Jones reached some years ago.

In the field, var. *glutinosum* occurs in a wide variety of habitats. In the St. George, Washington Co., Utah area, and to some degree, to the south, the variety occurs on sandy soils. In the Grand Canyon it may be found clinging to the canyon walls. In much of its Utah range, it occurs among broken rocks and ledges in protected areas, unlike var. *corymbosum* which is usually found in the more open sites and on clay hills.

LITERATURE CITED

- BROTHERSON, J. D. 1967. A study of community relationships of *Eriogonum corymbosum* Benth. in DC. in Uintah Basin, Utah. Unpublished master's thesis, Brigham Young University.
- DAVIS, R. J. 1952. Flora of Idaho. Dubuque, Iowa.
- GANDOGHER, M. 1906. Le genre *Eriogonum* (Polygonaceae). Bull. Soc. Bot. Belg. 42:183-200.
- GRAY, A. 1876. Miscellaneous botanical contributions. Proc. Amer. Acad. 11: 71-104.
- HANSON, C. A. 1962. Perennial *Atriplex* of Utah and the northern deserts. Unpublished master's thesis, Brigham Young University.
- HOLMGREN, A. H. 1962. The vascular plants of the Dinosaur National Monument. Utah State University, Logan, Utah.
- JONES, M. E. 1895. Contributions of Western Botany. No. VII. Proc. Calif. Acad. Sci. II, 5:611-733.
- . 1903. *Eriogonum*. Contr. West. Bot. 11:4-18.
- LANJOUW, J. et al., editors. 1966. International Code of Botanical Nomenclature. Regnum Vegetabile vol. 46. Utrecht, Netherlands.
- & F. A. STAFLEU. 1964. Index Herbariorum. 5th Edition. Regnum Vegetabile vol. 31. Utrecht, Netherlands.
- NELSON, A. 1902. Contribution from the Rocky Mountain Herbarium. III. Bot. Gaz. 34:21-35.
- . 1904. New plants from Wyoming. XV. Bull. Torrey Bot. Club 31: 239-247.
- REVEAL, J. L. In press a. New species of *Eriogonum* from Utah. Madroño.
- . In press b. A new annual *Eriogonum* from Utah. Ann. Mo. Bot. Gard.
- . In press c. *Eriogonum jonesii* S. Wats. Southwest. Nat.
- . IN: MUNZ, P. A., in press. *Eriogonum*. Supplement to A California Flora. University of California Press, Berkeley.
- RYDBERG, P. A. 1912. Studies on the Rocky Mountain flora. XVII. Bull. Torrey Bot. Club 39:301-328.
- . 1917. Flora of the Rocky Mountains and adjacent Plains. New York, New York.

- SMALL, J. K. 1906. Studies in North American Polygonaceae. II. Bull. Torrey Bot. Club 33:51-57.
- STOKES, S. G. 1936. The genus *Eriogonum*, a preliminary study based on geographic distribution. San Francisco, California.
- . 1943. Further studies in *Eriogonum*. V. Leaflet. West. Bot. 3:200-202.
- TIDESTROM, I. T. 1925. Flora of Utah and Nevada. Contr. U. S. Nat. Herb. 25:1-665.
- TORREY, J. & A. GRAY. 1857. Botany in: E. G. BECKWITH. Report of explorations for a route for the Pacific railroad, on the line of the forty-first parallel on north latitude. 2:115-132.
- . 1870. A revision of the Eriogoneae. Proc. Amer. Acad. 8:145-200.
- WELSH, S. L. 1957. An ecological survey of the vegetation of the Dinosaur National Monument, Utah. Unpublished master's thesis, Brigham Young University.
- & E. M. CHRISTENSEN. 1957. An ecological study of the vegetation of the Dinosaur National Monument. Proc. Utah Acad. 34:55-56.
- WILLIAMS, L. O. 1932. Field and herbarium studies. I. Bull. Torrey Bot. Club 59:427-429.
- WOOTON, E. & P. C. STANDLEY. 1913. Descriptions of new plants preliminary to a report upon the flora of New Mexico. Contr. U. S. Nat. Herb. 16:109-196.